H. Cooperative Monitoring, Evaluation, and Research Committee Work Plan

The state Forest Practices Board (the Board) established an adaptive management program in accordance with the requirements of the Forests and Fish Law (Appendix C) for the purpose of:

> "…providing science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives. (WAC 222-12-045)"

To provide the science needed to support adaptive management, the Board established the Cooperative Monitoring, Evaluation and Research Committee (CMER). The Board empowered CMER to carry out research and effectiveness and validation monitoring based on priorities contained in the Forest and Fish Report (Appendix B). The CMER Work Plan describes the projects and associated timelines and budgets for addressing research and monitoring needs identified in the Forests and Fish Report.

The goal of the FY2005 CMER Work Plan is to provide an integrated strategy for monitoring the effectiveness of the Forests and Fish forest practices rules to protect and maintain aquatic resources. The work plan is intended to inform CMER participants, policy constituents, and the interested public of CMER's activities.

Adaptive management and CMER's work is an integral part of the Forest Practices Habitat Conversation Plan. Therefore, CMER's Work Plan is important to understanding and predicting present and future areas of research and monitoring.

This page is intentionally left blank.

CMER FY 2005
WORK PLAN

Prepared by:

COOPERATIVE MONITORING, EVALUATION AND RESEARCH COMMITTEE

June 29, 2004

Comments or questions contact:

Geoff McNaughton, Adaptive Management Administrator
(geoffrey.mcnaughton@wadnr.gov)

Timothy Quinn, CMER Co-chairman
(quinntq@dfw.wa.gov)

Douglas Martin, CMER Co-chairman
(**doug@martinenv.com**)

TABLE OF CONTENTS

1.0 INTRODUCTION

BACKGROUND ON ADAPTIVE MANAGEMENT

The State Forest Practices Board (FPB) has adopted an adaptive management program in concurrence with the Forest and Fish Report legislation (State Forest Practices Rules WAC *222-12-045). The purpose of this program is to:

> "…provide science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives."

To provide the science needed to support adaptive management, the FPB established the Cooperative Monitoring, Evaluation and Research Committee (CMER). The FPB empowered CMER to implement research, effectiveness, and validation monitoring per guidelines set by the Forest and Fish Report (FFR). CMER is organized into a series of Scientific Advisory Groups (SAGs) that are responsible for designing and implementing the research and monitoring program.

PURPOSE AND OBJECTIVES OF THE CMER WORK PLAN

The goal of the FY2005 work plan is to provide an integrated strategy for monitoring the effectiveness of the Forest and Fish rules to protect and maintain aquatic resources. The work plan is intended to inform CMER participants, policy constituents, and the interested public in CMER's activities. The plan is a living document that will be revised in response to research findings, changes in policy objectives, and funding. This version supercedes the 2004 version of the work plan. Annual revisions to the work plan are anticipated in the future.

The work plan goal will be met by achieving six objectives:

1. Identifying critical research and monitoring questions (a process started in appendix LI and L2, FFR Report) that are pertinent to evaluating rule effectiveness
2. Organizing these questions into coherent program groupings
3. Assessing the risk and scientific uncertainty for each program
4. Developing an integrated strategy for accomplishing the work
5. Prioritizing programs/projects for implementation
6. Developing budget estimates and timelines for implementation.

ORGANIZATION OF THE WORK PLAN DOCUMENT

The work plan is organized in a hierarchical format. FFR "rule" groups form the highest level, programs occur within rule groups, and projects are defined within programs (e.g., Table 2). Research and monitoring questions are identified at the rule group level and are assigned to programs (topic groups). Then projects are developed within the programmatic strategy. In the remainder of this section we further define the rule groups and programs, and introduce the monitoring task framework that is being used by CMER. Sections 2 and 3 provide detailed

descriptions of the Rule Groups and Programs, respectively. Section 4 describes the procedure used by CMER to prioritize and rank the monitoring programs.

Rule Group Structure and Definition

A rule group is a set of forest practices rules relating either to a particular resource, such as wetlands, or fish-bearing streams, or to a particular type of forest practice, such as road construction and maintenance.

The rule groups are organized along the lines of the FFR appendices, including:

1. Riparian Strategy (FFR, Appendix B) which includes five sub-groups:
    a. Stream Typing
    b. Type N Streams
    c. Type F streams
    d. Bull trout
    e. Channel Migration Zones (CMZ)
2. Unstable Slopes (FFR, Appendix C)
3. Roads (FFR, Appendix D)
4. Fish Passage (included in FFR, Appendix D, Roads)
5. Pesticides (FFR, Appendix E)
6. Wetland Protection (FFR, Appendix F)
7. Wildlife

Program Structure and Definition

A program is a combination of one or more projects that is designed to address a set of related the scientific questions concerning a specific rule group. CMER organized these critical questions and issues into one or more research/monitoring programs. A description of each program including its purpose and objectives and the programmatic strategy for accomplishing the work is presented in Section 2.

Task Descriptions

CMER defined three task-based approaches to facilitate effectiveness monitoring at different spatial and temporal scales. This integrated approach includes an effectiveness monitoring approach that evaluates prescription effectiveness at the site scale; an extensive monitoring approach that evaluates status and trends in resource condition indicators across FFR lands; and, the intensive monitoring approach that measures causal relationships and cumulative effects at the watershed-scale. CMER also defined a rule implementation tool task that coordinates the development of scientific tools necessary for implementing the rule(s). CMER collaborates with the DNR on designing programs for rule implementation tools.

A more detailed description of these tasks follows. The rationale for this integrated monitoring approach is described in the Monitoring Design Team (MDT) Report (MDT, 2002).

Effectiveness/Validation Monitoring

Effectiveness monitoring/validation projects are designed to evaluate the performance of the prescriptions in achieving resource goals and objectives. Effectiveness monitoring may include several related projects such as research tool development and validation, pilot study, target identification, and effectiveness monitoring projects. Effectiveness monitoring differs from the other approaches in that it is directed at prescription effectiveness at the site-scale.

Extensive Monitoring

Extensive monitoring evaluates the current status and future trends of key watershed input processes and habitat conditions across FFR lands. Extensive monitoring provides a statewide assessment of the effectiveness of FFR rules to attain specific performance targets across FFR lands. This is different from prescription effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide report-card-type measures of rule effectiveness (i.e., are FFR performance targets and resource condition objectives being achieved on a landscape scale over time) that can be used to determine if progress is consistent with expectations.

Intensive Monitoring

Intensive monitoring is watershed-scale monitoring that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and biological effects of FFR rules on aquatic resources. The evaluation of cumulative effects from multiple management actions on a system requires an understanding of the effects of individual actions on a site and the interaction of those responses through the system. Such understanding is the basis for effectiveness-evaluation of management practices as applied at multiple locations over time. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how aquatic resources respond to these habitat changes. This sophisticated level of understanding of the physical and biologic systems can only be achieved with an intensive, integrated, monitoring effort of a watershed. CMER has identified several potential intensive monitoring topics and is currently scoping and prioritizing critical questions to be addressed by an intensive monitoring program.

Rule Implementation Tool Development in cooperation with DNR

The development of rule implementation tools includes efforts to develop, refine or validate methods, guidelines, protocols, models or targets required to implement forest practices rules. Typical projects include the development, testing, and refinement of field protocols or models to identify or delineate landscape features requiring FFR prescriptions. One example is the Last Fish Model to predict the distribution of fish habitat in headwater streams. The presence or absence of fish habitat is the key resource concern that drives implementation of riparian buffer prescriptions. Other projects consist of studies designed to verify performance targets developed during FFR negotiations, such as the DFC basal area targets.

2.0 RULE GROUP DESCRIPTIONS AND MONITORING STRATEGIES

This section provides a summary, rationale, strategy, and list of programs for each rule group. The rule summary briefly describes the intent of the rule, the rationale identifies scientific questions related to those rules, and the strategy organizes those questions into programs and task categories.

RIPARIAN STRATEGY

Because of the complexity of the riparian strategy, it is divided into five rule groups: the Stream Typing rule group (Type F/N delineation), the Type N rule group (non-fish-bearing streams), the Type F rule group, the Bull Trout rule group, and the Channel Migration Zone Rule Group. Each group is discussed separately below.

STREAM TYPING RULE GROUP

The FFR recommends adoption of rules by the forest practices board delineating waters of the state into three categories, Type S Waters, Type F waters and Type N waters. Distinguishing the upper limits of Type F (or S) waters is particularly important, because the presence or absence of fish habitat in the streams creates differences in the aquatic resources of concern, the management strategies and the prescriptions applied.

Rule Summary

Currently, stream typing is based on a complicated set of physical and beneficial use criteria according to guidance in the forest practice rules. Due to questions about the accuracy of this system, the FFR report recommends development of a statewide stream type map using a multi-parameter, field verified, GIS logistic regression model to identify the upper extent of Type F streams.

Strategy and Rationale

The FFR report provides a clear rationale and guidance for a strategy related to the stream typing system. The FFR report indicates that the current approach to stream typing is not adequately precise, defines a modeling approach for developing a new mapping, and sets specifications for the accuracy of the model. It also calls for development of a field protocol for inclusion in the forest practices board manual.

The Instream Scientific Advisory Group (ISAG) has developed a single program (the stream typing program) to develop and validate a GIS based model to predict the upstream extent of fish or fish habitat (Table 1).

Table 1. Stream typing rule group critical question and program.

Stream Typing Rule Group Critical Questions	Program Name	Task Type
How can the demarcation between fish- and non-fish-habitat waters be accurately identified?	Stream Typing Program	Rule Tool

TYPE N RIPARIAN PRESCRIPTIONS RULE GROUP

Type N streams are non-fish-habitat streams that either do not provide suitable habitat to support fish or do not contain fish because of a natural barrier to fish migration. Type N streams are protected under FFR for several reasons. First, they provide habitat for stream-associated amphibians (SAA) covered by the agreement. Second, water quality standards pertaining to these streams need to be met. Finally, Type N streams contribute water, nutrients, woody debris, and sediment that affect downstream fish habitat and water quality.

The Type N riparian prescriptions are designed to accomplish the following FFR resource objectives:

1. Provide cool water by maintaining shade, groundwater temperature, flow, and other watershed processes controlling stream temperature,
2. Provide complex in- and near-stream habitat by recruiting large woody debris and litter,
3. Prevent the delivery of excessive sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams, and
4. Provide conditions that sustain SAA population viability within occupied sub basins.

Rule Summary

Two buffering strategies are prescribed for Type Np streams, the clear-cut and the partial-cut strategies. The clear-cut strategy is prescribed for the west side, whereas landowners on the eastside have the flexibility to use either clear-cut or partial-cut strategies. The clear-cut strategy involves a patch buffering system where portions of the riparian stand can be clear-cut to the stream and other areas are protected with a 50-ft wide no-cut patch buffer. The patch buffer includes fixed and flexible components. Fixed components include 50-ft buffers around the sensitive sites (e.g., connected springs and seeps, Np initiation points; and stream junctions) and on both sides of the stream upstream 300-500 ft from the Type F/Type Np boundary. The flexible component allows the landowner to choose where to place the remaining buffer to bring the total buffer length to 50% of the Type-Np length. Eastside landowners have the option of using the 'partial-cut' strategy', a continuous 50 ft buffer along the length of the Type Np stream. The partial-cut buffer can be thinned, providing that the appropriate basal area and leave tree requirements are met. A 30 ft wide equipment limitation zone (ELZ) is established on all Type N streams (Np and Ns) to minimize sediment input from bank and soil disturbance. Operations within the ELZ are designed to avoid soil disturbance, and sediment delivery must be mitigated.

Strategy and Rationale

The Type N rules are based on the assumption that the riparian buffering strategies will result in aquatic conditions that meet the resource objectives and consequently achieve the three FFR performance goals. However, great uncertainty exists about these assumptions because the functional relationships between riparian management practices, riparian functions and aquatic resource response are not well studied or understood. Several major areas of uncertainty include:

1. How to identify the upper boundary of perennial flow in Type N streams,

2. How riparian stands and the inputs and functions they provide respond to management practices and the level of protection provided by the prescriptions,
3. The habitat utilization patterns of Stream Associated Amphibians and their response to riparian management practices, and
4. The effects of Type N riparian management practices on sediment, large woody debris (LWD), temperature and nutrient regimes in downstream fish-bearing streams.

The Type N riparian strategy is designed to address critical questions related to the effectiveness of the rules in achieving FFR goals and resource objectives. The critical questions, programs, task types and responsible scientific advisory group (SAG) are listed in Table 2.

Table 2. Critical questions and programs for the Type N riparian prescriptions rule group.

Type N Riparian Prescriptions Rule Group Critical Questions	Program Name	Task Type	SAG
How should the initiation point of Type Np streams be identified for management purposes?	Type N Delineation Program	Rule Tool	UPSAG
How do survival and growth rates of riparian leave trees change following Type Np buffer treatments? Are riparian processes and functions provided by Type Np buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall? How do other buffers compare with the FFR Type N prescriptions in meeting resource objectives? Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives?	Type N Buffer Characteristics, Integrity and Function	Effective-ness	RSAG
Is Stream Associated Amphibian (SAAs) population viability maintained by the Type N prescriptions?	Type N Amphibian Response	Effective-ness	LWAG
Can the methods used to identify and characterize sensitive sites be improved?	Sensitive Site Program	Rule Tool	LWAG
Is the Type N riparian strategy effective in maintaining downstream fish habitat and harvestable fish populations?	Downstream Water Quality/Fish Response	Intensive	
What is the current status of riparian conditions and functions in Type N streams on a statewide scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type N)	Extensive	RSAG

TYPE F RIPARIAN PRESCRIPTIONS RULE GROUP

The FFR report recognizes differences in riparian systems and processes between eastern (Eastside) and western (Westside) Washington. It describes the goal of the riparian strategies for Westside Type F (fish-bearing) streams as follows:

> "…Riparian silvicultural treatments and conservation measures that are designed to result in riparian conditions on growth and yield trajectories towards what are called 'desired future conditions.' As used in this report, desired future conditions are the stand conditions of a mature riparian forest, agreed to be 140 years of age (the midpoint between 80 and 200 years) and the attainment of resource

> objectives. …These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an endpoint of riparian stand development."

The eastern Washington riparian rules for Type F streams provide for stand conditions that: 1) vary over time within the range of historic disturbance regimes, 2) provide riparian functions needed to meet resource goals for fish, amphibians and water quality, and 3) maintain forest health by minimizing risk of catastrophic damage from insect, disease or fire.

The FFR assumes that riparian forests managed in accord with these strategies will provide adequate levels of key riparian functions (providing large woody debris, shade, and nutrients and preventing sediment input) necessary to meet FFR resource objectives for harvestable levels of salmonids, long term viability of amphibian populations and protection of water quality while maintaining a viable timber industry. These key functions are the focus of the resource objectives and performance targets established for this rule group.

Rule Summary

The Type F riparian rules prescribe riparian management zones (RMZs) that differ between the Eastside and Westside but share common characteristics. The common characteristics are a RMZs equal in width to a site-potential tree height and divided into three zones: core, inner and outer. The core zone is adjacent to the stream and generally is a no harvest zone. The core is intended to protect bank stability and maintain the majority of shade and wood recruitment. The inner and outer zones extend outward from it and allow prescribed harvesting to under specific conditions.

Westside Type F Prescriptions

Western Washington RMZs consist of three zones, including:

1. A core zone 50 feet wide that is generally a no-harvest zone.
2. An inner zone extending from 10 to 100 feet beyond the core zone (depending on the site class and stream size) where the management objective is to place the combined core and inner zone on a trajectory to grow into the desired future condition (DFC).
3. An outer zone extending beyond the inner zone to the edge of the RMZ where timber harvest is managed to protect special sites and wildlife habitat and contribute to the overall riparian functions provided by the RMZ.

A variety of measures in the Westside Type-F riparian rules address site-specific situations, operational concerns of landowners, conversion of hardwood-dominated sites to conifer, placement of large wood, catastrophic loss from fire or wind, and alternate plans.

Eastside Type F Prescriptions

The eastern Washington Type-F riparian rules require:

1. A core 30-foot wide that is generally a no harvest zone.
2. An inner zone that is 45 to 70 feet wide (depending site class and stream size).
3. An outer zone is between 0 to 55 feet wide.

The sum of the core, inner and outer zones approximates the length of a site-potential tree, which varies with site class. Allowable harvest within the inner and outer zones is different for each of three elevation bands, referred to as timber habitat types in the rules. These elevation bands were intended to emulate variations in natural disturbance regimes, variations in species distributions, and other riparian characteristics. Guidance for selecting RMZ leave trees based on size and species are intended to move riparian stand conditions towards larger trees of fire and disease resistant species. Two temperature rules overlay the Eastside Type F riparian rule package. The first defines the amount of shade needed to meet state water-quality standards. The second (the bull trout overlay) is intended to provide the additional temperature protection required by bull trout (see Bull Trout Rule Group, below).

Strategy and Rationale

The western Washington Type F riparian rules are based upon the assumptions that:

1. The DFC basal area targets adequately describe mature riparian forest conditions.
2. The growth model used for DFC adequately projects riparian growth and mortality.
3. Some hardwood-dominated riparian stands need to be converted to conifer in order to achieve DFC.
4. Stands that meet the DFC target will provide the aquatic habitat conditions needed to provide the functions to meet the overall performance goals and resource objectives.

The eastern Washington Type F riparian rules are based upon the following assumptions:

1. The management strategies in the Type-F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2. The defined elevation bands are reasonably accurate reflections of the spatial distribution of historical disturbance regimes and species compositions
3. The management strategies will minimize risk of catastrophic events within the RMZs.
4. The management strategies will put stands on a trajectory that will provide the riparian functions needed to support harvestable populations of fish.
5. The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs of bull trout.

Uncertainties about the validity of the assumptions and the effectiveness of the rule lead to a series of critical questions and programs to address them (Table 3). The effectiveness programs include:

1. The Type F Statewide Effectiveness Monitoring Program, which will address effectiveness of the Type F riparian rules in meeting performance targets and achieving resource objectives;
2. The Hardwood Conversion Program, which will address uncertainty regarding strategies and prescriptions for managing hardwood dominated stands;
3. The Extensive Riparian Trend Monitoring Program, which will document status and trends of riparian conditions on Type F streams on a regional scale; and,
4. The DFC Validation Program, a rule tool program that addresses uncertainties regarding the validity of the west side DFC performance targets and the accuracy of DFC model that is used to project stand trajectory to age 140.
5. The Eastside Riparian Type F Program will assess current riparian stand and stream conditions on Type F streams across the eastside, and evaluate the likelihood that the

prescriptions will move stands towards desired future conditions (forest health, riparian function, and within historic disturbance regimes). It also will develop eastside LWD performance targets and validate the shade-temperature relationships for eastern Washington in the forest practices rules.

6. The Eastside Temperature Nomograph Program that will validate the shade-temperature relationships for eastern Washington in the forest practices rules.
7. The Bull Trout overlay temperature program will address effectiveness of the eastside Type F shade requirements. This program is discussed in the Bull Trout rule group.

Table 3. Critical questions and programs for the Type F riparian prescriptions rule group.

Type F Riparian Prescriptions Rule Group Critical Questions	Program Name	Task Type	SAG
Does the DFC model, including basal area targets, adequately describe mature riparian forests?	DFC Validation Program	Rule Tool	RSAG
Are the Type F riparian rules effective in meeting the performance targets, resource objectives, and overall performance goals of FFR?	Type F Statewide Effectiveness Monitoring Program BTO Temperature Program	Effective-ness	RSAG BTSAG
Where and how should hardwood conversion projects be conducted, and what are the ecological outcomes?	Hardwood Conversion Program	Effective-ness	RSAG
What is the current range of conditions for eastside riparian stands and streams? Will application of the prescriptions result in stands that achieve eastside FFR riparian prescription objectives (forest health, riparian function and historic disturbance regimes)? What are appropriate LWD performance targets?	Eastside Type F Riparian Program	Rule Tool	SAGE
Can the shade/temperature relationships in the eastside temperature nomograph be refined?	Eastside Type F Riparian Program	Rule Tool	SAGE
What is the current status of riparian conditions and functions in Type F streams on a regional scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type F)	Extensive	RSAG
How do aquatic organisms respond to changes in habitat and water quality associated with changes in riparian inputs and functions?	Aquatic Habitat Biotic Response	Intensive	RSAG

BULL TROUT RULE GROUP

Bull Trout are listed under ESA as threatened throughout their range in Washington. A factor contributing to their "threatened" status is the degradation of habitat, especially increasing stream temperatures. Bull Trout temperature requirements are cooler than those of other salmonid species. The bull trout habitat overlay (a map showing the distribution of potentially suitable habitat) was developed to identify streams containing potential bull trout habitat.

Rule Summary

Specific riparian timber harvest prescriptions apply to Type F streams located within the bull trout habitat overlay area. When a timber harvest unit is located within the overlay, "all available shade" must be retained within 75 feet of the bankfull width or channel migration zone, whichever is greater. When outside of the overlay, prescriptions fall under the standard shade rule, which can allow for harvest of a portion of shade trees within the 75 feet, depending on elevation and canopy cover existing prior to harvest. The standard shade rule, which was designed to meet earlier state water quality temperature standards, is believed to be inadequate to meet the optimal bull trout water temperatures.

Strategy and Rationale

Problems arise during implementation of the bull trout overlay. Because knowledge of the current and potential distribution of the species is imprecise, large areas of forest land in eastern Washington are currently included within the bull trout overlay. Some included areas may never have been occupied by bull trout and may not have the potential to support bull trout in the future. The riparian zones bordering these streams are placed under inappropriate restrictions that may result in riparian conditions that do not meet the intent of the Eastside riparian strategy.

The Bull Trout "All Available Shade" Rule is based on the following assumptions:

1. Shade and water temperature are more at risk in eastern Washington than in western Washington because of the potential for more shade removal within the Eastside RMZ prescriptions and warmer Eastside air temperatures.
2. The water temperature criteria within the current (prior to 2004) water quality standards (and nomograph) are too warm to meet the optimal cold water temperature needs of bull trout.
3. A primary factor contributing to bull trout decline is habitat degradation, especially as it relates to stream temperature. Past forest practices, including shade removal, have been a contributing factor. Therefore with restoration of habitat and the consequential reduction in stream temperatures, bull trout should rebound in those habitats.
4. Historically when habitats were more optimal, watersheds were more extensively occupied by bull trout, including all life history strategies such as resident and migratory (i.e. fluvial and adfluvial).
5. The bull trout habitat overlay includes areas that never have and never will have the potential to support bull trout. Where this occurs, forestlands may be placed under inappropriate harvest restrictions.
6. The "all available shade" rule should provide more shade and water temperature protection than the standard eastside prescriptions.
7. The densiometer methodology can adequately measure and determine "all available shade".
8. All shade affecting stream temperature comes from within 75 feet of the stream.

The following list of uncertainties apply to the bull trout "all available shade rule"

1. Lack of agreement on bull trout temperature requirements.
2. Different perspectives exist regarding the accuracy of the bull trout habitat overlay in identifying habitat potentially suitable for bull trout.
3. The characteristics of "unsuitable" bull trout habitat are poorly defined.

4. The effectiveness of the densiometer methodology for determining effective shade, especially "all available shade" is not fully accepted.
5. The meaning of "all available shade" is unclear.

The strategy for the bull trout rule group is intended to answer a set of critical questions that address these uncertainties (Table 4).

Table 4. Critical questions and programs for the Bull Trout rule group. All programs are administered by BTSAG.

Bull Trout Rule Group Critical Questions	Program Name	Task Type
Are both the standard eastside prescriptions and the "all available shade" rule effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature? Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule? Are FFR riparian prescriptions effective at protecting groundwater flow and temperature?	BTO Temperature Program	Effective-ness
How can habitat suitable for bull trout be identified?	Bull Trout Habitat Identification Program	Rule Tool

Two programs are proposed to address these questions. The Bull Trout Overlay Temperature Program is designed to address the effectiveness of FFR rules on shade and stream temperatures in bull trout habitat, as well as other eastside fish habitat. The Bull Trout Habitat Identification Program is identifying bull trout habitat for management purposes.

CHANNEL MIGRATION ZONE RULE GROUP

The channel migration zone (CMZ) is an area within a river or stream valley where the active channel is prone to move laterally.

Rule Summary

The intent of the CMZ rule is to maintain riparian forest functions (e.g. woody debris recruitment, bank reinforcement, shade, and litter) along migrating channels. No timber harvest, salvage, or road construction (except for road crossings) is allowed within CMZs without an alternate plan that specifies the conditions which will provide equal and overall effectiveness of public resources as described in the rules and the Forest Practices Act.

Strategy and Rationale

The strategy for the CMZ rule group is intended to answer a set of critical questions that address uncertainties concerning CMZ delineation and effectiveness (Table 5). The overall strategy is to

assess the delineation methods for CMZs while cooperating with the riparian rule group to develop and implement a long-term riparian/CMZ effectiveness-monitoring program. The CMZ rule group is divided into three programs addressing the critical questions.

The first question arises from the need to identify and delineate the CMZ so that the prescriptions can be implemented as intended. The rule assumes that the CMZ can be identified and the extent of the channel migration zone can be and will be consistently delineated by landowners. This assumption has high uncertainty because although many CMZs are relatively easy to recognize their boundaries are difficult to define in the field. Incorrect delineation of the CMZ edge results in incorrect placement of the adjacent RMZ, making it potentially vulnerable to channel disturbance.

The second question addresses the future patterns of channel migration. The CMZ rule is based on the assumption that the area subject to channel migration during the last 100 years is the same area that will be subject to channel migration during the next 100 years. A high level of uncertainty exists for this assumption because changes in land-use and other factors (i.e. in channel wood, sediment and flow) during the next 100 years could change the frequency of channel avulsion (the most common form of channel migration in forested conditions) leading to increased rates of migration.

The third question addresses the effectiveness of the CMZ rule in maintaining RMZ integrity and riparian functions. The rule assumes that riparian functions can be maintained by protecting forests in the CMZ and RMZ to provide riparian functions despite the effects of rapidly migrating channels. However, alternative plans may not be equally successful because of a lack of information and experience on the part of landowners and regulators. Moreover, changing forest practices increase the uncertainty because past migration patterns may not predict future migration and fluvial disturbance of the RMZ is likely.

Table 5. Critical questions and programs for the CMZ Rule Group. All effectiveness tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Channel Migration Zone Rule Group Critical Questions	Program Name	Task Type
What field/map criteria allow consistent, repeatable delineation of the CMZ lateral boundaries ("edge")?	CMZ Delineation Program	Rule Tool
Will the physical processes that drive channel migration change appreciably due to the application of FFR rules?	CMZ Validation Program	Intensive
Does the CMZ rule meet FFR performance goals and resource objectives?	CMZ Effectiveness Monitoring Program	Effective-ness

UNSTABLE SLOPES RULE GROUP

The FFR goal for unstable-slopes management is to prevent forest practices from increasing mass wasting (landslides) beyond the naturally occurring rate. The intent of the rule is to protect water quality and aquatic habitat by minimizing sediment delivery from forestry-related increases in mass wasting.

Rule Summary

The FFR default protective measure for unstable slopes is avoidance. The rule strategy begins with identification of unstable slopes and then the strategy is either to avoid the area or conduct a risk evaluation through the SEPA process. The rule strategy relies on the ability of forest managers to recognize and mitigate for unstable slopes within a forest practice application (FPA) and approval process. If forest practices are planned on potentially unstable slopes, the FPA application process includes a SEPA review. The correct identification and assessment of unstable slopes is achieved by the rules defining unstable landforms at a statewide level and DNR regions defining regional unstable landforms using local knowledge. As further protection, a specific FFR rule relates to timber harvest on the groundwater recharge areas of deep-seated landslides in glacial sediments.

Strategy and Rationale

Table 6 presents a set of critical questions for the unstable slopes rule group and identifies a series of programs to address them. The strategy is to immediately implement an unstable-landform identification program to address the first two critical questions, and then to design and implement mass wasting effectiveness monitoring and validation programs to assess the effectiveness of landform recognition and mitigation at various scales. All effectiveness, extensive, and intensive tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Table 6. Critical questions and programs for the Unstable Slopes Rule Group.

Unstable Slopes Rule Group Critical Questions	Program Name	Task Type
What screening tools can be developed to assist in the identification of potentially unstable landforms that minimize the omission of potentially unstable landforms?	Unstable Landform Identification Program	Rule Tool
Are deep-seated landslides in glacial sediments along with their recharge area being correctly and uniformly identified, and does harvesting of the recharge area promote their instability?	Glacial Deep-Seated Landslides Program	Rule Tool
Are unstable landforms being correctly and uniformly identified and evaluated for potential hazard?	Mass Wasting Effectiveness Monitoring Program	Effective-ness
What is the natural (background) rate of landsliding on managed forest lands?		
Are the FFR unstable-landform rules reducing the rate of management-induced landsliding at the landscape scale?		
Are the mass wasting prescriptions and mitigation measures effective in preventing landslides from roads and harvest units?		
What levels of cumulative sediment inputs are harmful to the resource at the basin scale?	Mass Wasting Validation Program	Intensive

ROADS RULE GROUP

The intent of the rules for roads is to protect water quality and riparian/aquatic habitat by minimizing sediment delivery to Type 1-5 waters and changes in hillslope and stream hydrology due to roads. Fish passage at road crossing structures is treated as a separate rule group.

Rule Summary

The road rules protect water quality and riparian/aquatic habitats through prescriptions and road Best Management Practices (BMPs). Implementation of these prescriptions through road maintenance and abandonment plans (RMAP) is intended to minimize road-surface sediment production and the hydrologic connection between the road system and the stream network. The road rules specify prescriptions for road construction, maintenance and abandonment, landings, and stream-crossing structures. In addition, the Board Manual identifies BMPs for roads and landings. The rules require RMAPs for all forest roads to be developed by 2006 for large forest landowners, and timed with timber harvest activity for small forest landowners.

Strategy and Rationale

The basic assumptions of the road rules are

1. Implementation of road prescriptions will result in achieving FFR performance goals and resource objectives, including:
   a. Meeting water quality standards,
   b. Providing clean water and substrate and maintain channel forming processes by minimizing the delivery of management-induced coarse and fine sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,
   c. Maintaining surface and groundwater hydrologic regimes (magnitude, frequency, timing, and routing of stream flow). This will be accomplished by disconnecting road drainage from the stream network, preventing increases in peak flows causing scour, and maintaining the hydrologic continuity of wetlands.
2. Assessment and planning using RMAPs is the best method to assure effective implementation of BMPs and this will achieve the above objectives.
3. Roads differ in their degree and importance of impact to the resources of concern, and we can identify and prioritize roadwork based on these differences.
4. Appropriately identified standard BMPs are effective at achieving functional objectives.

Assessment of the rules leads to five critical questions. Three monitoring and validation programs are proposed to address these critical questions (Table 7). The monitoring strategy is based on CMER's experience with road sediment problems and BMPs and on the data from numerous Watershed Analyses used to develop the FFR road performance targets for sediments. The effectiveness-monitoring strategy includes both a site-scale program and a basin-scale program. Validation of the road performance targets, which is more complex and time-consuming, will come later. This approach will first inform the uncertainties about BMP effectiveness and their ability to meet FFR targets. If BMPs are ineffective, validation monitoring is unwarranted. If BMPs are proving to be effective, then validating the performance targets should begin (do we have the right target?).

Table 7. Critical questions and programs for the Roads Rule Group. All effectiveness, extensive, and intensive tasks are administered by UPSAG.

Roads Rule Group Critical Questions	Program Name	Task Type
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions that are covered under the Mass Wasting Rule Group).	Road Basin-Scale Effectiveness Monitoring Program	Effective-ness
Does the RMAP process correctly identify priority fixes including orphan roads and fish passages (see Section 2.9)?	Roads Prescription (Site-Scale) Effectiveness Monitoring Program	
Are road prescriptions effective at meeting site-scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions, which are covered in the Mass Wasting Rule Group section).		
Have the correct performance targets for sediment delivery and connectivity been identified?	Roads Validation Program and Cumulative Sediment Effects.	Intensive
What levels of cumulative sediment inputs are harmful to the resource at the basin scale? (Validation of road sediment targets).		

FISH PASSAGE RULE GROUP

The intent (objective) of the fish passage rule is to install, upgrade and/or maintain stream crossings by 2016 that provide fish passage at all life stages.

Rule Summary

Fish passage blockages at road crossing structures are to be addressed as part of the road maintenance and abandonment plan (RMAP) process. Road crossing structures will be inventoried and evaluated, and those acting as fish barriers are to be prioritized as to amount of potential fish-bearing stream affected. Those structures that do not provide fish passage must be repaired or replaced within 15 years, typically on a "worst-first" basis. WDFW's hydraulic code rules, the associated barrier-assessment manual, and DNR's forest practices rules apply to crossing structures on forest roads.

Strategy and Rationale

Critical questions were developed through an analysis of the FFR rules during which the assumptions and uncertainties underlying the rule were identified. From these uncertainties, two critical questions were derived (Table 8). The fish passage rule is based on the following assumptions:

1. Achieving the objective of no fish barriers is critical for recovery of depressed stocks and the health of fish at all life stages.
2. Implementation of the rules will result in achieving the objective to maintain or provide passage for fish in all life stages and to provide for the passage of woody debris likely to be encountered.

3. Assessment, prioritization, and implementation of RMAPs will achieve the objectives in a timely manner.
4. Current stream crossing replacement standards are adequate to address fish and all life history stages.
5. Hydraulic code criteria are effective at achieving resource objectives.
6. Fish species and all life history stage distributions can be characterized statewide.
7. Performance targets have not been can be developed for fish at all life history stages.
8. Stream simulation methods provide passage for fish (definition WAC 222-16-010) and all life history stages.

Table 8. Critical questions and programs for the Fish Passage Rule Group. All effectiveness and extensive tasks are administered by ISAG.

Fish Passage Rule Group Critical Questions	Program Name	Task Type
Are the corrective measures effective in restoring fish passage for fish at all life history stages?	Fish Passage Effectiveness Monitoring Program	Effective-ness
What is the current status of fish passage on a regional scale, and how are conditions changing over time?	Extensive Fish Passage Monitoring Program	Extensive

PESTICIDES RULE GROUP

The objectives of the pesticides rule group is to manage pesticide use to achieve water quality standards, meet label requirements, and avoid harm to riparian vegetation. In the context of the forest practices rules pesticide means "any insecticide, herbicide, fungicide or rodenticide, but does not include nontoxic repellents or other forest chemicals."

Rule Summary

The pesticide rules include a series of regulations that cover: 1) aerial application of pesticides, 2) ground application of pesticides with power equipment, and 3) hand application of pesticides. The rules for aerial application of pesticides prescribe a setback (offset) to prevent application of pesticides within the core and inner zones of Type F and S streams, or the wetland management zone (WMZ) of Type A or B wetlands. In these cases the offset is from the outer edge of the inner zone or the WMZ. Offsets are also prescribed for flowing Type N streams and Type B wetlands < 5 acres, however in these cases the offsets are measured from the edge of the bankfull channel or wetland. The offset distances vary depending on water type, the type of nozzle used, and wind conditions at the time of application. Separate guidelines govern ground application of pesticides with power equipment and hand equipment within RMZs and WMZs.

Strategy and Rationale

The main assumption is that the pesticide rules will be effective in achieving the objectives of meeting water quality standards, label requirements and preventing damage to vegetation in RMZs and WMZs. A level of uncertainty exists for the aerial application of pesticides because of the potential difficulties caused by terrain and wind conditions. A single critical question has been developed, with a corresponding effectiveness program (Table 9).

Table 9. Critical questions and programs for the Pesticides Rule Group.

Pesticides Rule Group Critical Questions	Program Name	Task Type
Do the pesticide rules protect water quality and vegetation within the core and inner zones of Type S and F RMZs or the WMZs of Type A or B wetlands?	Forest Chemicals Program	Effective-ness

WETLAND PROTECTION RULE GROUP

Wetland adaptive management goals are identified in the FFR report as:

> "The goal … is to clarify the mapping of wetlands and provide for an assessment of the functions of associated wetlands. This is intended to include an assessment of the functions served by forested wetlands and the potential impacts of harvest activities in forested wetlands. The assessment may include the determination of harvest activities that cannot be adequately mitigated or recovered. Where such assessments suggest that changes in forest practices are required, this Appendix is intended to provide the mechanism for the consideration of additional rules for the protection of such wetlands."

The intent of the wetland rules is to achieve no net loss of wetland function (water quality, water quantity, fish and wildlife habitat, and timber production) by avoiding, minimizing, or preventing sediment delivery and hydrologic disruption from roads, timber harvest, and timber yarding. The main strategy is to use forest and fish rules and watershed analyses as the primary vehicle for implementing wetland BMPs.

Rule Summary

The forest practices rules classify wetlands into two categories. Type A wetlands include non-forested wetlands with an area greater than 0.5 acres or forested wetlands and non-forested bogs with an area greater than 0.25 acres. Type B wetlands included non-forest wetlands with an area greater than 0.25 acres. Landowners are required to inventory and map wetlands as part of their FPA for timber harvest or road construction. Wetland management zones (WMZ) are prescribed for all Type A wetlands and Type B wetlands greater than 0.5 acres. The WMZs have variable widths based on the wetland type and area. The specific leave tree requirements within WMZs differ for eastern and western Washington. The use of ground based harvesting equipment is restricted within WMZs. Harvest methods are limited to low impact harvest or cable systems within forested wetlands and landowners are encouraged to leave a portion of the wildlife reserve tree requirement within the wetland. Additional rules apply to road construction to assure that there is no net loss of wetland function. The preferred option is to prevent impacts by locating roads outside of wetlands, however where this is not possible, the guidelines seek to minimize and mitigate impacts.

Strategy and Rationale

The wetland rules are based on the following assumptions:

1. Implementation of the wetland prescriptions will result in achieving no net loss of wetland functions over a timber rotation, assuming that some wetland functions may be reduced until the mid-point of a timber rotation cycle.
2. Assessment and planning in watershed analysis and implementation of forest practices rules will achieve the stated resource objectives.
3. Appropriately identified, standard BMPs are effective at achieving the resource objectives.
4. Forested wetlands will successfully regenerate following timber harvest.

Several uncertainties exist about the validity of these assumptions. The wetland functions listed in the rules are limited and significant uncertainty exists regarding their adequacy to meet the resource objectives of the FFR report. The degree to which current rules for wetland mitigation will achieve the "no net loss of wetland function" policy is unclear because no objective performance measures are available for determining the:

1. Range of wetland functions affected by road construction, harvest and harvest methods or
2. Net loss or gain of these functions over time.

These assumptions and uncertainties guided development of critical questions and research and monitoring programs to address them (Table 10).

Table 10. Critical questions and programs for the Wetlands Rule Group.

Wetlands Rule Group Critical Questions	Program Name	Task Type
Are forested wetlands regenerating sufficiently to maintain wetland functions?	Wetlands Revegetation Effectiveness Program	Effective-ness
Are road construction activities, harvest and harvest methods adequately mitigated to achieve no net-loss of wetland functions?	Wetland Mitigation Program	Effective-ness
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids? Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect temperatures in connected streams? Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	WMZ Effectiveness Monitoring Program	Effective-ness
How should wetlands be classified and mapped for management purposes?	Wetland Tools Program	Rule Tool

The approach of the wetlands rule strategy is to establish through a comprehensive literature review the current scientific basis for evaluating wetland functional relationships for salmonids, covered species and water quality and quantity. The literature review will be followed by development of tools to map wetland locations (GIS Layer) and describe wetland functions (Hydro-geomorphic HGM classification system). Specific effectiveness/validation studies will be developed to answer specific questions about the effects of rule implementation at the landscape and site scales. All effectiveness tasks are administered by WETSAG; rule tools are administered by DNR in collaboration with WETSAG.

WILDLIFE RULE GROUP

CMER has funded a number of wildlife research projects since the late 1980s. These projects have addressed general multi-species and statewide issues, as well as species-specific concerns about the effects of forest practices. Although the FFR agreement is focused on water quality, fish, and SAAs, both the Policy Committee and CMER acknowledge that wildlife issues are important and need attention. Consequently CMER is currently funding additional sampling and analyses of a study that examines wildlife use of two streamside buffer designs. However, because CMER's focus is currently on FFR priorities, the only funding available for additional wildlife projects is from the State general fund.

Rule Summary

Forest practice rules directed at wildlife conservation take two approaches: 1) general statewide requirements, and 2) species-specific strategies. In addition, FFR rules may benefit wildlife through the retention or enhancement of habitat, such as riparian buffers, upland management areas, landslide hazard zonation, etc. The only general statewide rule specifically directed at wildlife conservation is the provisions for wildlife reserve tree management (WAC 222-30-020[11]). Specifications for the retention of wildlife reserve trees, green recruitment trees, and down logs are provided for both eastern and western Washington. Species-specific forest practice rules are closely tied to state and federal endangered and threatened species programs. Habitat of listed species is defined as critical habitat (state) and any proposed forest practice activity in critical habitat becomes a Class-IV Special forest practice under SEPA (WAC 222-10-040), requiring consultation, evaluation, an environmental impact statement, and mitigation. There are currently 10 species for which these rules apply, e.g., the bald eagle (*Haliaeetus leucocephalus*), grizzly bear (*Ursus arctos*), northern spotted owl (*Strix occidentalis*), and marbled murrelet (*Brachyramphus marmoratus*).

A species-specific approach that avoids direct rule making has been endorsed by the Forest Practices Board. This approach is the development and adoption of management plans or the specification of "voluntary" guidelines. The federal listing of the lynx (*Lynx canadensis*) prompted the state and a few large private landowners in northeastern Washington to develop and adopt a lynx management plan. The state listing of the western gray squirrel (*Sciurus griseus*) resulted in landowners agreeing to apply forest practice guidelines developed by the Washington Department of Fish and Wildlife in areas known to contain the species. These rules and associated guidelines are very complex. Each species generates specific definitions of habitats, specific monitoring methods, and specific provisions for protection of sites that vary with the species needs. In addition, the Forest Practices Board often adopts rule options that allow landowners to develop species-specific management plans.

Strategy and Rationale

The Landscape and Wildlife Advisory Group (LWAG) has been developing an overall wildlife work plan for several years. However, focused plan development for wildlife issues other than those associated with FFR were delayed until the FFR work plan is completed. Nonetheless, LWAG continues to work on the broader work plan as issues and time allows. To date, LWAG has identified a number of subprograms that contain several issues, each with critical questions (Table 11).

Table 11. Wildlife issues (in order of priority) and critical questions that are addressed by LWAG in different forums.

Wildlife Rule Group Critical Questions	Program Name	Task Type
What are the values of snags retained in upland management units and RMZs? Is there a threshold response by wildlife to snag density? What are the fates of wildlife reserve trees (WRT) and green recruitment trees (GRT) in managed forests? What are the most-effective ways of retaining and replacing snags?	Effectiveness of snags for wildlife	Effectiveness Validation
What are the effects of variation in stand establishment practices, herbicides, thinning, fertilization, and rotation lengths on vegetation and wildlife? Does the concept of the steady-state shifting mosaic apply and how does that process effect wildlife?	Conifer management effects on wildlife	Validation Effectiveness
What role do RMZs, UMAs, and other forest patches play in maintaining species and providing structural and vegetative characteristics thought to be important to wildlife? What are the functions of large legacy trees (snags, down wood, high stumps) as compared to the smaller complements produced in intensively managed forests? What are the roles and fates of special sites (e.g., rock outcrops, cliffs, talus slopes, isolated small wetlands, etc.) in managed forests?	Legacy features and their effect on wildlife	Effectiveness Validation
What are the movement patterns, processes, and distances of amphibians in managed forests? Do amphibians persist in refugia following timber harvest or is subsequent occupancy related to movements from other areas? How quickly do amphibians re-colonize areas, particularly habitat outside the stream network? What is the role of ponds created by beaver, slumps, rotational failures, road ditches, and sediment traps, and off-channel habitats in the distribution and abundance of still-water breeding amphibians?	Amphibian movement and distribution effectiveness monitoring	Effectiveness
What is the status and trends of bats in managed forests?	Forest Bats	Extensive
What is the role of WRTs and GRTs in bat ecology? What are the relationships between forest management and bat foraging and roosting?	Forest Bats	Effectiveness
What is the relationship between the abundance and productivity of wildlife and gradients in the composition and structure of ponderosa pine stands?	Ponderosa Pine Habitat	Effectiveness
What are the effects of forest practices on the western gray squirrel and oviposition sites of egg-laying reptiles? What is the role of isolated oak trees and small patches of oaks? What are the appropriate management approaches to maintaining and restoring oak woodlands at stand and landscape levels?	Oak woodland Habitat	Effectiveness

3.0 PROGRAM DESCRIPTIONS

This section describes the purpose and research strategy for each CMER program. The program descriptions are organized by task category, beginning with effectiveness monitoring programs, followed by extensive monitoring programs, rule tool programs and the intensive monitoring program. The program description includes the identification of specific projects that will be implemented to address critical questions. Low priority projects (see Section 4), may or may not be fully scoped and developed at this time. Eventually, over time, all projects and the rationale for conducting them will be included in the program descriptions.
Effectiveness Monitoring Programs

Type N Buffer Characteristics, Integrity and Function Program

Purpose

The purpose of this program is to evaluate the FFR Type N riparian management prescriptions, including the composition, growth and mortality of buffer trees, the level of riparian functions provided, the biotic and water quality responses to the prescriptions, and their effectiveness in achieving performance targets and meeting water quality standards.

Type N prescriptions are highly uncertain because they are based on many assumptions that have not been adequately studied or validated. This program addresses the major Type-N assumptions and uncertainties by focusing on four critical questions.

1. How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?
2. Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?
3. What riparian protections measures are needed to meet resource objectives and performance standards?
4. Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?

Strategy

The effectiveness of the Type N riparian management prescription package is uncertain because there are many gaps in the scientific understanding of headwater streams, their aquatic resources, and their response to different riparian management strategies. Consequently, the prescriptions are based on assumptions that have been neither thoroughly studied nor validated. This program is designed to answer critical questions concerning the effectiveness of both the FFR Type N riparian prescriptions and alternative riparian management prescriptions (Table 12). Three effectiveness projects will be undertaken to accomplish this goal:

1. The Type N FFR Buffer Integrity, Characteristics and Function Project will provide data on a random sample of FFR Type N buffers from approved forest practice applications (FPAs) to evaluate buffer performance over the range of conditions occurring in the FFR landscape.

2. The Type N Experimental Buffer Treatments Project will evaluate FFR Type N buffers by comparing them with alternative buffer treatments in a paired-basin experimental setting. This study will focus on quantifying resource responses to different buffer strategies that require intensive sampling and a controlled experimental design (e.g. amphibian response, litterfall, temperature and downstream nutrient export).
3. The DNR Type 5 experimental buffer treatment project is a cooperative study with DNR and USFS of experimental riparian buffer treatments for Type 5 headwater streams. Participation in this study will provide data on the response of Type 5 streams to different buffering strategies as well as experience in monitoring small headwater streams.

Implementation of these three projects will provide a substantial amount of useful information for adaptive management in Type N riparian prescriptions, including an assessment of the variability in the survival performance of the FFR Type N prescriptions across the FFR landscape, and intensive comparison of instream and downstream aquatic resource response to varying Type N buffering strategies. Once these projects are underway, it is envisioned that the Type N performance target validation project will be designed to test and refine FFR performance targets for Type N riparian prescriptions. Data on the response of buffers, the level of riparian functions provided and aquatic resource response gained from the three buffer effectiveness projects will be used to define the approach taken by this project. Finally, the Type N classification project is currently a concept that remains to be scoped and developed.

Table 12. Type N Buffer Characteristics, Integrity and Function Program.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?	Type N FFR Buffer Integrity, Characteristics and Function Project
Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall?	Type N Buffer Integrity, Characteristics and Function Project Type N Experimental Buffer Treatments Project
How do different buffering strategies compare with the FFR Type N prescriptions in meeting resource objectives?	Type N Experimental Buffer Treatments Project
Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?	Type N Performance Target Validation Project
Do different types of Type N channels explain the variability in the response of Type N channels to forest practices?	Type N Classification Project

Project Descriptions

Type N Buffer Integrity, Characteristics and Function Project (Table 26, line 4)

The Type-N FFR buffer integrity, characteristics, and function project will evaluate the effectiveness of the FFR Type-N riparian prescriptions, including survival of buffer leave trees, stand condition and trajectory over time, and changes in riparian functions including shade, LWD recruitment, and stream bank protection. Randomly sampling Type N forest practices and pairing the "treatment" sites with un-harvested control sites will provide an unbiased estimate of variability for the performance of the buffers relative to the Type N performance targets. The

design for this project has been approved and funded by CMER. Initial post-harvest sampling at 15 treatment control pairs in the western Washington western hemlock zone strata was initiated in the fall of 2003.

DNR Type 5 Experimental Buffer Treatment Project (Table 26, line 5)

This is a cooperative project with DNR and USFS that compares the response of riparian stands, temperature, litter fall, nutrients**,** small mammals, amphibians, and downed wood to a range of buffer treatments applied in sets of small paired watersheds. This design provides the high level of control needed to distinguish differences in response to variations in buffer treatments. This information, in combination with the results from the buffer integrity, characteristics, and function study, is essential for understanding how effective the different elements of the FFR prescriptions are for resource protection. Baseline data collection is underway, with harvests scheduled to begin in the fall of 2003. CMER provided funding to assist with baseline data collection in the summer of 2003.

Type N Experimental Buffer Treatment Project (Table 26, line 6)

A draft study plan for this project is currently being developed under the supervision of LWAG with assistance from BTSAG, RSAG and UPSAG. As currently envisioned, this study is designed to compare the effect of three different Type N buffer treatments with an untreated control. The study design involves establishing several blocks, consisting of adjacent type N basins where the various treatments and control are applied. Pre- and post-harvest data on variables such as amphibian populations, riparian stand characteristics, tree mortality and LWD recruitment, shade and stream temperature, litter fall, light, stream flow, water chemistry, particulate and invertebrate export and stream bank erosion will be collected and compared to document change. In order to include amphibians, the study sites are confined to basins with basaltic geology in the southwestern part of the state.

Type N Performance Target Validation Project (Table 26, line 8)

The Type N Performance Target Validation Project has been neither scoped nor designed. It will probably consist of one or more studies designed to validate the relationships between Type N performance targets and aquatic resource response. This comparison will ensure that the performance targets provide a meaningful indication that FFR resource objectives are being achieved.

Type N Classification Project (Table 26, line 9)

The Type N Classification Project has been neither scoped nor designed. It will explore potential methods of classifying Type N streams to provide a context for interpreting channel response to management practices. The project will identify important physical processes that affect the results of the above projects, the findings of the N Amphibian Response programs and contribute to the integration of Type N functions and processes.

Type N Amphibian Response Program

Purpose

The purpose of this program is to addresses critical questions concerning the response of SAAs to forest practices, particularly the Type N riparian prescriptions. Many uncertainties exist regarding the distribution of SAAs, their life history and habitat utilization patterns, population

dynamics, effects of forest practices on SAA habitats, and the response of SAA populations to these changes. Consequently, the Type N riparian rule is based on the assumption that buffering of perennial Type N streams around 'sensitive' sites (sites thought to provide high quality SAA habitat), will maintain the viability of SAA populations. These assumptions and uncertainties have been examined and used to develop a series of sub-questions under the main critical question (Table 13).

Table 13. Type N Amphibian Response Program.

Critical Questions	Project
Is SAA population viability maintained by the Type N prescriptions? Do SAAs continue to occupy and reproduce in the patch buffers? Do SAAs continue to occupy and reproduce in the ELZ only reaches?	SAA Detection/ Relative Abundance Methodology Project
If SAAs do not continue to occupy the ELZ only reaches, do they re-occupy those reaches before the next harvest? How does SAA habitat respond to the sensitive site buffers? How does SAA habitat respond to variation in inputs, e.g. sediment, litter fall, wood? How do SAA populations respond to the Type N prescriptions over time?	Type N Experimental Buffer Treatment
What are the common findings and inconsistencies in published studies on the effects of timber harvest on tailed frogs? What can be learned from a meta-analysis of published data and unpublished data on tailed frogs in managed forests?	Tailed Frog Literature Review & Meta-analysis Project
Are published generalizations on the relationship between parent geology and tailed frog abundance correct and consistent?	Tailed Frog and Parent Geology Project
What are the common findings and inconsistencies in published studies on the habitat associations of Dunn's & Van Dyke's Salamanders?	Dunn's & Van Dyke's Salamander Project
What are the effects of various levels of shade retention on the stream-breeding SAAs? Is there an optimum level of shade retention? Does territoriality in high quality habitat confound interpretation of SAA relative abundance estimates?	Buffer Integrity-Shade Effectiveness Project
What are the effects of 3 buffer treatments on SAAs, 2 years post-harvest?	Amphibian Recovery Project

Strategy

The restricted distribution of SAAs and the lack of information about them required the development of an amphibian response strategy that differs from that of many other rule groups. This program began with the development of tools needed to implement the Type N buffer rule for sensitive sites (i.e., SAA sensitive sites identification methods and characterization) and procedures to detect and determine the relative abundance of SAAs for monitoring purposes.

During this time other projects designed to determine critical monitoring questions for some species (i.e., tailed frog literature review and meta-analysis) or answer species-specific L-1 questions were undertaken (i.e., Dunn's and Van Dyke's salamanders). Following the completion of these projects effectiveness monitoring will begin.

The restricted distribution of SAA and uneven abundance further limited the amphibian response program. LWAG determined that an extensive monitoring project for SAAs would not provide useful information for the FFR adaptive management program and cooperation with other monitoring projects was not possible. LWAG concluded that any monitoring program must focus on those physical factors (e.g., geology) that appear to effect SAA distribution, abundance, and response to timber harvest (i.e., the Type N Experimental Buffer Treatment Project described in Section 3.1.1).

Project Descriptions

SAA Detection/Relative Abundance Methodology Project (Table 26, line 15)

The SAA Detection/Relative Abundance Methodology Project is currently underway. It is designed to evaluate and develop a standard methodology for sampling SAAs in headwater forest streams. It addresses the need for a research/monitoring methodology to detect amphibians and determine their relative abundance. The most widely used methods produce high variance estimates and detection probabilities are unknown. The project should be completed before future SAA research projects are initiated.

Tailed Frog Literature Review & Meta-analysis Project (Table 26, line 16)

Of the 6 FFR SAAs, the tailed frog may be the most extensively studied due to an inclusive distribution in the coastal Pacific Northwest. There are enough published studies on this species that a synthesis of those results is useful in helping LWAG develop a research and monitoring program. In addition, the published data sets, as well as several that are not published, will be the subject of a meta-analysis. That analysis may or may not support the literature review synthesis and will likely identify other factors related to tailed frog distribution and response to timber harvest that will be useful in developing LWAG's program. The literature review is completed and the meta-analysis is underway.

Tailed Frog and Parent Geology Project (Table 26, line 18)

This is a new project proposed to begin in 2005. Recent studies in managed forests have emphasized the relationship between parent geology, stream substrate composition, and tailed frog abundance. The general hypothesis has emerged that tailed frogs are most abundant in streams on geologies the produce hard or competent rock (volcanic basalt) vs. those that do not (marine sandstones). However, a study in Olympic National Park found that tailed frogs were abundant on both marine and volcanic parent material. However, these studies were largely observational and the distinction between geologies was an extrapolated finding of the results. This project will test the parent geology hypothesis throughout Washington. The design of the study is currently being developed.

Dunn's & Van Dyke's Salamander Project (Table 26, line 17)

The FFR indicates that LWD may be important for Dunn's and Van Dyke's salamanders. However, general habitat descriptions for both these species emphasize the importance of

streamside rocky substrates. The first part of this project was a literature review to determine the basis for the LWD connection to these species in the FFR. The next phase of the project was a study designed to provide additional information on the role of LWD in these species habitats. Both phases have been completed.

Buffer Integrity-Shade Effectiveness Project (Table 26, line 19)

The effects of blow down on SAAs in Type N patch buffers are largely unknown. However, blow down is unpredictable in time and space, precluding a passive monitoring approach. One of the primary effects of blow down is a reduction in shade. This project will examine the effects of four levels of shade retention on tailed frog and torrent salamander density, body condition, and spatial distribution, water temperature, primary productivity, and macro-invertebrates. This is a cooperative project between Longview Fibre Company and Washington Department of Fish and Wildlife. Longview Fibre is conducting the study within the range on the Columbia and Cascades torrent salamanders and WDFW within the range of the Olympic torrent salamander. Tailed frogs are also found within the range of all 3 torrent salamanders. Longview Fibre began a pilot study in 2003.

Amphibian Recovery Project (Table 26, line 20)

In 1998, the National Council for Air and Stream Improvement (NCASI) funded a study by Dr. Rhett Jackson on the effects of 3 buffer treatments on headwater streams in the Willapa Hills and Olympic Peninsula. Many of the FFR SAAs occurred on these sites. The NCASI funding covered a year of pre-treatment data and immediate post-harvest sampling. This project collected additional data, 2 years post-harvest. This project was completed in 2003.

Type F Statewide Prescription Monitoring Program

Purpose

The purpose of this program is to undertake research and monitoring to evaluate the effectiveness of the FFR Type F riparian prescriptions, compare and evaluate alternative Type F buffer treatments, and to validate the Type F performance targets. The program is designed to address scientific uncertainty about the prescriptions for type F streams, including:

1. The survival of buffer trees and rates of buffer tree mortality from wind-throw, disease, insects and other factors,
2. Post-harvest changes in conifer-dominated Westside RMZs, and whether Westside stands will remain on trajectory to achieve DFC performance targets,
3. Post-harvest changes in conifer-dominated eastside RMZs, and whether eastside riparian stands will remain within desired ranges and
4. Uncertainty about the level of riparian functions provided by riparian stands produced by FFR Type F prescriptions, and whether or not FFR resource objectives and performance targets will be achieved.
5. The efficacy of alternative buffer designs in providing riparian functions and meeting resource objectives and performance targets.
6. The validity of various performance targets.

Strategy

Implementation of the Type F statewide prescription-monitoring program was identified as a priority by CMER in the January 2003 program ranking process. The program is designed to answer a series of critical questions that will reduce scientific uncertainty concerning the effectiveness of the Type F prescriptions and the response of riparian stands, functions and aquatic resources to riparian management practices. Table 14 lists the critical questions and the projects that address them.

Table 14. Type F Statewide Prescription Monitoring Program critical questions and projects.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR Type F buffer treatments?	Type F Riparian Prescription Monitoring Project
Do stands in Type F RMZs remain on trajectory to DFC (west side) or within desired ranges (east side)?	
Do riparian functions meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall following application of the riparian Type F prescriptions?	
Would alternative approaches to the FFR Type F prescriptions be more effective in meeting FFR resource objectives and performance targets, while reducing costs or increasing flexibility for landowners?	Type F Experimental Buffer Treatment Project
Are the Type F performance targets valid and meaningful measures of success in meeting resource objectives?	Type F Performance Target Validation Project

The program is being implemented in stages. The Type F riparian prescription-monitoring project is the first project to be implemented, because the greatest uncertainties concern the effectiveness of the current FFR Type F prescriptions. Depending on the results of this project, a second project may be implemented to test the effectiveness of alternative buffer designs (the Type F experimental buffer treatment project). Finally, the response of aquatic organisms and resources to different levels of riparian inputs and functions needs to be examined to determine if the Type F performance targets are valid and meaningful measures (Type F Performance Target Validation Project).

Project Descriptions

Type F Riparian Prescription Monitoring Project (Table 26, line 26)

In January of 2003, CMER approved the N/F Riparian Prescription Monitoring study design, which included a study design for monitoring the effectiveness of the Type F riparian prescriptions. RSAG has decided to implement the Type F riparian prescription effectiveness monitoring project in stages, beginning with the Eastside. RSAG, in conjunction with BTSAG and SAGE, is currently developing a proposal to conduct eastside Type F effectiveness monitoring at the paired treatment control sites used for the Bull Trout Overlay temperature study.

Type F Experimental Buffer Treatment Project (Table 26, line 28)

The Experimental Type F Buffer Treatment Project has been neither scoped nor designed. This project design, particularly the identification of appropriate alternative prescriptions for testing, will be based on the results of the Type F riparian prescription-monitoring project.

Type F Performance Target Validation Project (Table 26, line 29)

The Type F Performance Target Validation Project has been neither scoped nor designed.

Hardwood Conversion Program

Purpose

The purpose of this program is to inform the FFR strategy for addressing hardwood riparian stands that are the legacy of past timber harvest practices. Many riparian stands that were formerly conifer dominated are currently dominated by hardwoods as a result of past logging practices. These hardwood stands probably will not achieve DFC without active intervention. Large uncertainties are associated with the identification of sites where conversion is an appropriate management strategy, the cost and effectiveness of different silvicultural techniques, and the trade-offs between short-term effects and long-term benefits.

Strategy

Table 15 presents the critical questions and projects of the Hardwood Conversion Program. The program consists of one project, the Hardwood Conversion Project, which is underway.

Table 15. Hardwood Conversion Program critical questions and projects.

Critical Questions	Project
How effective are different hardwood conversion treatments in re-establishing conifers in hardwood-dominated riparian stands?	Hardwood Conversion Project
Is hardwood conversion in riparian stands operationally feasible and what are the economic costs and benefits of the hardwood conversion treatments?	
What effects do hardwood conversion treatments in riparian stands have on shade, stream temperature and LWD recruitment?	

Project Description

Hardwood Conversion Project (Table 26, line 49)

The Hardwood Conversion Project is a series of case studies. They consist of landowner designed and implemented site-specific harvests of hardwood trees in riparian buffers. In each case, harvest is followed by replanting of conifers. Pre- and post-conversion monitoring will document the effects on instream and riparian habitat measures and on regeneration success. In addition, RSAG is contemplating other projects to address specific aspects of hardwood conversion, such as studies to determine how to identify sites where hardwood conversion is an appropriate management strategy, and to assess the distribution and characteristics of hardwood-dominated riparian stands on FFR lands.

Bull Trout Overlay Temperature Program

Purpose

This program addresses the effectiveness of Eastside FFR rules in meeting shade and temperature requirements for bull trout habitat.

Strategy

The Bull Trout Temperature Overlay (BTO) Program consists of three projects that address the critical questions in Table 16. The projects are designed to compliment and build upon each other by first determining the effectiveness of both eastside riparian prescriptions ("all available shade" [BTO]; and standard shade rules) on shade, solar energy, and stream temperature. Conceptual models are also being developed to determine potential forest practices effects on groundwater and stream temperature.

Table 16. BTO Temperature Program.

Critical Questions	Projects
Are both the standard eastside shade rules and the "all available shade" rule effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature?	BTO Temperature (Eastside Riparian Shade/Temperature Effectiveness) Project
Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule?	Solar Radiation/Effective Shade Project
Does timber harvest affect the temperature of groundwater entering streams?	Groundwater Conceptual Model Project

Project Descriptions

BTO Temperature (Eastside Riparian Shade/Temp. Effectiveness) Project (Table 26, line 36)

The BTO Temperature Project is designed to evaluate the effectiveness of both the "all available shade" rule and the standard Eastside riparian prescriptions in meeting FFR resource objectives, and to determine if a difference exists between shade and stream temperature provided by the BTO "all available shade" prescriptions and the standard FFR shade requirements. This field study is administered by BTSAG and is currently in the site-selection and pre-harvest data collection stages. It is combined with the Solar Radiation /Effective Shade Project.

Solar Radiation/Effective Shade Project (Table 26, line 37)

The Solar Radiation/Effective Shade Project is designed to evaluate whether "all available shade" is actually achieved under the BTO shade rule. This study, which is being done in conjunction with the BTO Temperature (Eastside Riparian Shade/Temperature Effectiveness Study) is in the site selection and pre-harvest data collection stages.

Groundwater Conceptual Model Project (Table 26, line 38)

The on-going Groundwater Conceptual Model Project is designed to investigate the potential impacts of timber harvest on groundwater temperatures, which subsequently can discharge to streams and thereby affect the temperature regime of fish habitat. A literature review is completed and a conceptual model is being developed to identify areas that are highly susceptible to groundwater heating after timber harvest.

Groundwater Research Studies (Table 26, line 39)

These projects have been neither scoped nor designed.

CMZ Effectiveness Monitoring Program

Purpose

The purpose of the channel migration zone (CMZ) effectiveness monitoring program is to determine the degree to which CMZs protect riparian management zones from migrating channels and protect migration zone functions.

Strategy

The CMZ effectiveness monitoring program addresses two critical questions:

1. Does the CMZ rule meet FFR resource and functional objectives by:
   a. Protecting trees subject to recruitment as a result of channel migration?
   b. Protecting off-channel aquatic resources?
   c. Providing adequate LWD and shade to the channel?
   d. Maintaining natural rate of sediment input from banks?
2. Are riparian processes and functions being maintained in alternate plans for CMZ protection?
   a. What are the riparian processes and functions provided by the CMZ that must be maintained in alternate plans?
   b. Do riparian functions and processes vary regionally?
   c. What short- and long-term changes in riparian processes should be considered acceptable in the development/approval of alternate plans?

Effectiveness monitoring of CMZ functions (first question) has a low uncertainty because the rule provides full protection of the CMZ. The uncertainty is greater for the effectiveness of alternate plans in maintaining CMZ riparian functions (second question). The effectiveness-monitoring program addresses these uncertainties through three projects.

The CMZ effectiveness monitoring program has a low priority and has neither been scoped nor designed. Program results could require Policy to revisit the requirement for alternative plans and redefine the lateral boundaries of the CMZ.

Project Descriptions

CMZ Function Assessment Project (Table 26, line 57)

A literature review of off-channel and riparian functions and physical processes provided by CMZs. This project has been neither scoped nor designed.

CMZ Integrity Monitoring Project (Table 26, line 58)

This project is a retrospective study of existing CMZs to assess their integrity and the degree to which the CMZ and RMZ have been impacted by lateral migration. This project has been neither scoped nor designed.

CMZ Alternate Plan Assessment Project (Table 26, line 59)

Monitoring CMZs with alternate plans to assess the degree to which off-channel and riparian functions have been preserved. This project has been neither scoped nor designed.

Mass Wasting Effectiveness Monitoring Program

Purpose

The purpose of this program is to assess the degree to which implementation of the FFR rules is preventing or avoiding an increase landsliding beyond natural background levels. The rules assume that:

1. The administrative process of identifying, reviewing, and regulating forest practices on potentially unstable slopes will maintain a naturally occurring rate of mass wasting following forest practices.
2. Implementation of the unstable slopes prescriptions will achieve the Schedule L-1 Resource Objectives of clean water and substrate and maintain channel-forming processes.
3. Implementation of the unstable slopes prescriptions will meet FFR landscape-scale targets (there are no site-scale targets).

Strategy

The Mass Wasting Effectiveness Program will address the critical question that defines the program: "Are the mass-wasting prescriptions effective in meeting the performance targets?" The strategy is to 1) evaluate effectiveness of identifying unstable slopes for applying prescriptions (avoidance or mitigation), and then 2) to evaluate effectiveness at two scales, the landscape scale (Extensive Monitoring) and the site scale (prescription monitoring). Landscape-scale monitoring will evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis. Site-scale or prescription level monitoring will use a "post-mortem" analysis on a sample of landslides to determine if and how management actions were responsible for triggering the landslide. This will include landslides associated with roads, harvest, and/or leave areas (e.g., windthrow-triggered). UPSAG will coordinate the two scales of monitoring by conducting prescription level "post-mortems" within watersheds evaluated in the landscape-scale monitoring. This will allow for interpretation of results across multiple scales; i.e., how does the effectiveness (or ineffectiveness) of specific prescriptions contribute to the total effect of landslides at the landscape scale? There are currently two competing and/or complimentary monitoring designs for extensive monitoring for mass wasting under consideration by UPSAG. Evaluation of these designs from current and planned pilot projects is expected to be completed by the end of 2004. Table 17 (below) lists critical questions identified for mass wasting effectiveness monitoring and the associated projects.

Project Descriptions

<u>Effectiveness of Unstable Landform Identification Project (Table 26, line 31)</u>

Considerable variability and bias exists between investigators when determining hazard areas associated with unstable (e.g., high-risk) landforms. The extent of this variability and/or bias, and the degree of influence it has on accurately identifying hazards in the field are unknown. This study will a) consider approaches to test the extent of accuracy and bias in slope hazard identification, specifically

1) Are unstable slopes currently being uniformly recognized?
2) Are some unstable slopes currently going unrecognized?
3) Is the hazard of unstable slopes being correctly and uniformly recognized?

Table 17. Mass Wasting Effectiveness Monitoring Program.

Critical Questions	Project
Are unstable landforms being accurately and consistently identified in the field?	Effectiveness of Unstable Landform Identification Project
Are forest practices preventing or avoiding an increase in landsliding beyond natural rates of mass wasting?	Mass Wasting Landscape-Scale Effectiveness Monitoring Project
What field protocols will be used for assessing the causal mechanism of landslides at the site scale? Are unstable slope rule strategies failing to prevent landslides, and if so, how?	Mass Wasting Prescription-scale Effectiveness Monitoring Project
Does wind-throw on mass-wasting buffers (leave areas) increase mass wasting?	Mass Wasting Buffer Integrity and Wind-throw Assessment Project

This study will provide recommended improvements to reduce variability related to proper hazard identification and assessment.

Mass Wasting Landscape-Scale Effectiveness Monitoring Project (Table 26, line 34)

This project will be designed to evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis. In broad terms, the trend monitoring will include sites that sample statewide variability in the factors that control landslide occurrence. These sites will consist of tracts containing both FFR-regulated lands and other forest lands under no or less extensive management (representative of natural or background conditions). Landslide rates and volume fluxes from both will be compared. Data to infer status and trends will consist of an inventory of landslides using aerial photography, terrain, topographic, forest cover, and road network maps. The current status will be assessed using existing data, monitoring for trends will require collection of additional data over time for each site.

Mass Wasting Prescription-Scale Effectiveness Monitoring Project (Table 26, line 32)

This project will be designed to conduct prescription-scale monitoring of landslides in FFR-compliant units to determine the degree to which management actions were responsible for triggering the landslide. This study will include landslides associated with roads, harvest, and leave areas, to determine the effectiveness of the current management strategies (typically avoidance) on preventing landslides. This project will help validate the effectiveness-monitoring project (and vice versa).

Mass Wasting Buffer Integrity and Windthrow Assessment Project (Table 26, line 33)

This project will be designed to test the effect of windthrow in mass wasting leave areas on overall landslide rates. There is a school of thought that suggests that mass wasting leave areas are especially prone to windthrow. If that is true, then mass wasting leave areas would be counter-productive for reducing sediment load to streams.

Roads Sub-basin Scale Effectiveness Monitoring Program

The roads program assumes that performance targets are correct, which allows the testing of effectiveness against those targets. The effectiveness-monitoring program for roads is planned

for two scales: 1) monitoring at the sub-basin scale and, 2) monitoring at the site scale. FFR established performance targets at the sub-basin scale.

Purpose

The purpose of the roads sub-basin scale effectiveness-monitoring program is to determine the degree to which road prescriptions are effective at meeting performance targets for sediment and water established at the sub-basin scale.

Strategy

At the sub-basin scale, road monitoring assesses the effectiveness of the road rules at meeting the FFR performance targets for sediment and hydrologic connectivity across ownerships and regions of the state. Because the rules provide for a 15-year implementation window for new road rules, this program is long-term and results will provide a periodic evaluation of the trend and the trajectory toward meeting the performance targets by 2016.

The road sub-basin scale effectiveness-monitoring program currently consists of three projects that are related to critical questions in Table 18. Two projects revise and validate the analytical model to estimate road-surface erosion (WARSEM) that is being used in the monitoring program to estimate sediment contributions and connectivity from selected road segments and road systems.

Table 18. Road Sub-basin Scale Effectiveness Monitoring Program.

Critical Program Questions	Projects
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water?	Road Sub-Basin-Scale Effectiveness Monitoring Project
Are field or analytical methods needed to support the monitoring program?	Road Surface Erosion Model Update Project
How accurate is the road surface erosion model in predicting average road sediment from run off at the site scale?	Road Surface Erosion Model Validation/ Refinement project

Project Descriptions

Road Surface Erosion Model Update Project (Table 26, line 23)

The road surface erosion model within the Surface Erosion Module of the Washington Forest Practices Board Manual on Standard Methodology for Conducting Watershed Analysis (version 4.0, November 1997) is an empirically derived model widely used for estimating surface erosion and sediment delivery to streams from forest roads. The primary purpose of this project is to refine and adapt the model for use in forest road monitoring and an assessment method. Revisions include standardizing input variables and developing repeatable application protocols. This project also includes development, testing, and refinement of standardized protocols for field application of the revised road surface erosion model for use at the site and road segment scale. This project produced the Washington State road surface erosion model (WARSEM in 2003.

Road Sub-Basin-Scale Effectiveness Monitoring Project (Table 26, line 22)

The main purpose of this project is to provide data that can be used to assess the degree to which sub-basin scale performance targets, and therefore resource objectives, are being met throughout the state. Data collected at the sub-basin scale will determine the status and assess trends of key indicators of road connectivity and using WARSEM sediment delivery through time. It does not address performance targets for road performance relative to mass wasting erosion processes, which are more readily evaluated through other monitoring projects. Forest road systems in randomly selected sample areas that are proportionately distributed statewide in areas under FFR rules, independent of ownership will be monitored. Data will be collected to determine the degree to which roads meet established performance targets and the strength of the relationship between those reported measures and the percent of sample area under implemented RMAPs. Because road monitoring at the sub-basin scale is expected to extend to the 15-year road rule implementation period, this piece will be put in place before model validation and performance target validation. A draft monitoring design is currently under review by the CMER members.

Road Surface Erosion Model Validation/Refinement Project (Table 26, line 24)

WARSEM is based on empirically derived data. This project will expand the data sets for model parameters identified during the model update project listed above. This project will also provide an opportunity to add to and update the model relationships from on-going academic and industry sponsored data collection. The scope of work or study plan for this work has not yet been initiated.

Roads Site-Scale Effectiveness Monitoring Program

Site-scale effectiveness monitoring provides more immediate insights into the effectiveness of road prescriptions than does sub-basin-scale monitoring program. Because the FFR prescriptions are tied to implementation of RMAPs, monitoring must also occur within this context. The site-scale subprogram requires the development of site-specific road performance measures (based on prescription objectives), the testing of site-level effectiveness using RMAP areas as a sampling stratum, and the development of field protocols for site-scale performance measures. The road site-scale effectiveness monitoring program will inform the rules at several levels by determining the degree to which strategies are achieving resource objectives at the site scale, assessing the need to modify individual RMAPs to achieve resource objectives, and assessing the need to modify guidelines and rules for road maintenance and abandonment planning.

Purpose

The dual purposes of the roads site-scale effectiveness monitoring project are to (1) determine the degree to which maintenance activities within RMAPs are appropriately prioritized, and (2) assess the effectiveness of specific best management practices (BMP) in meeting their intended objective(s).

Strategy

As described in Table 19, an important issue related to road effectiveness monitoring is the degree to which maintenance activities targeted in the RMAPs are appropriately identified and prioritized based on rule language to fix the "worst first." Monitoring this aspect of the prescription strategy for roads is important because individual or collective prescriptions that are

effective in meeting resource protection goals if not applied to the right locations may not achieve resource objectives, and yet still incur cost to the landowner. Equally important is the assessment of the degree to which BMPs are effective in meeting their stated objective of either reducing sediment production or delivery or disconnecting roads from surface water. These two issues are best approached by concurrent projects.

We anticipate that the results of these studies will inform the FFR adaptive management process about the effectiveness of RMAP rules in achieving the FFR goals. Should RMAPs prove to be ineffective, Policy may have to revisit the rule to refine its requirements and application.

Table 19. Road Site-scale Prescription Effectiveness Monitoring Program.

Critical Program Questions	Projects
Are RMAP scheduled activities identified and prioritized appropriately?	Effectiveness of Identifying RMAP Priority Fixes Project
Are road prescriptions effective at meeting site-scale performance targets for sediment and water?	Road Site-Scale Effectiveness Monitoring Project

Project Descriptions

Effectiveness of Identifying RMAP Priority Fixes Project (Table 26, line 46)

The primary purpose of this project is to evaluate the degree to which RMAP priorities have been appropriately identified and scheduled. The project will audit a random sample of RMAPs state wide, and audit results will be used to inform the rules and guidelines related to RMAP scheduling. The development of the study design will begin once sub-basin scale monitoring begins.

Road Site-Scale Effectiveness Monitoring Project (Table 26, line 47)

The objectives of monitoring of forest roads at the prescription scale are to: (1) evaluate the effectiveness of road prescriptions in meeting site-scale sediment performance targets, and (2) identify sensitive situations where prescriptions are not effective. Site-scale effectiveness monitoring utilizes the information and landowner intentions presented in the RMAP, both individual and collectively. Treatments that do not meet site-specific performance targets will be analyzed using site data to determine the cause, the need for further evaluation, and a more appropriate alternative treatment. These sites may be candidates for BMP investigations, testing or refinement assuming no compliance or installation problems. Results from site-scale monitoring are anticipated within the short time frame of 2-4 years. UPSAG anticipates conducting this project in parallel with the sub-basin scale road-monitoring project. A draft monitoring plan is in progress.

Fish Passage Effectiveness Monitoring Program

Purpose

The focus and development of the Fish Passage Effectiveness Monitoring Program is pending Policy direction. In general, the program is intended to address the effectiveness of the Forest

Practices Rules in providing passage at road crossings for fish (as defined by WAC 222-16-010) at all life history stages (Table 20).

Table 20. Fish Passage Effectiveness Monitoring Program.

Critical Questions	Project
Are the corrective measures effective in restoring fish passage for fish at all life history stages?	Fish Passage Effectiveness Monitoring Project

Strategy

ISAG has developed and sent questions to Policy to better focus the intent of FFR regarding fish passage monitoring.

Project Description

Fish Passage Effectiveness Monitoring Project (Table 26, line 51)

This project has been neither scoped nor designed.

Forest Chemicals Program

Purpose

The purpose of this program is to address uncertainty concerning the effectiveness of the chemical application rules in protecting water quality and vegetation in riparian and wetland buffers. Alterative strategies with lower costs will also be considered.

Strategy

The program is under RSAG. This project assigned a low priority in CMER's January 2003 program prioritization process (Table 26, line). Scoping has not occurred and no projects have been identified.

Forested Wetlands Re-vegetation Effectiveness Program

Purpose

This program addresses uncertainty concerning the re-vegetation of forested wetlands following timber harvest.

Strategy

This program consists of four projects (Table 21). Schedule L-1 of the FFR states a key performance target for wetlands is "no net loss in the hydrologic functions of wetlands". Schedule L-2 H.9 directs the testing of the performance target from L-1 through research to "assess the hydrologic functions of forested wetlands, the effects of harvesting on stream flows and the effectiveness of prescriptions in meeting wetland targets." Among the list of issues is the evaluation of the regeneration and recovery capacity of forested wetlands. A literature review and synthesis of forested wetlands was performed to identify current understanding of forested wetland functions and regeneration capabilities in the Pacific Northwest. The review and

synthesis also identified informational gaps that will be used to identify further research considerations. A pilot project to evaluate methods for determining reforestation in forested wetlands is underway and will be followed by a study to determine the regeneration and recovery capacity of forested wetlands after timber harvest. Future studies of wetland and stream temperature interactions and hydrologic connectivity will further explore wetland functions and impacts associated with timber harvest.

Table 21. Forested Wetlands Re-vegetation Effectiveness Program

Critical Questions	Project
What is currently known about regeneration in forested wetlands in the Pacific Northwest? What are the information gaps? What is currently known about affects of timber harvest on forested wetland functions?	Forested Wetlands Literature Review & Workshop project
What are the current methods of evaluating regeneration in forested wetlands? How successfully are they being implemented? What results are landowners experiencing? What kind of guidance can be given to landowners to best ensure regeneration of forested wetlands? How does the stand compare in composition post harvest to pre-harvest conditions? How are forested wetland functions affected by timber harvest?	Statewide Forested Wetland Regeneration Pilot & Project
Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams?	Wetland/Stream Water Temperature Interactions Project
Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	Wetland Hydrology Connectivity Project

Project Descriptions

Forested Wetlands Literature Review and Workshop Project (Table 26, line 41)

This project is nearly completed. It has undergone CMER and SRC review. The comments received are now being reviewed and edited by WSAG. The project is scheduled to be completed by July 2004.

Statewide Forested Wetland Regeneration Pilot and Project (Table 26, line 42)

The pilot project is currently underway. A report on the results of the pilot is scheduled to be completed in late 2004 or early 2005. The main project is scheduled to begin in 2005.

Wetland/Stream Water Temperature Interactions Project (Table 26, line 43)

This project has been neither scoped nor designed. This project is not scheduled to begin until 2008.

Wetland Hydrologic Connectivity Project (Table 26, line 44)

This project has been neither scoped nor designed. This project is not scheduled to begin until 2007.

Wetland Mitigation Program

Purpose

Current forest practice rules require mitigation for filling of wetlands and replacement of lost wetland functions. Currently no information on the effectiveness of, or compliance with, these mitigation requirements is available.

Strategy

To address the performance target of "no net loss of hydrologic functions of wetlands", Schedule L-2 H.8 sets a goal to determine "wetland size and function requiring mitigation sequencing to achieve targets". This program will evaluate several critical questions (Table 22), including whether wetland mitigation projects are being conducted as required by the forest practices rules, and where conducted, if they are successful in achieving their stated goals and objectives and replacing lost wetland functions caused by wetland filling. This information can then be used to recommend any needed changes to the current process of wetland mitigation.

Table 22. Wetlands Mitigation Program

Critical Questions	Project
Is wetland mitigation being performed when required by the forest practice rules? Are wetland mitigation projects achieving their stated goals and objectives? Are wetland mitigation projects replacing lost wetland functions? What functions are not being replaced?	Wetland Mitigation Effectiveness Project

Project Description

Wetland Mitigation Effectiveness Project (Table 26, line 50)

The project will entail reviewing projects that involved the filling of wetlands due to road or landing construction. It will be determined if mitigation was required. Field evaluation of the sites will be conducted. The project is scheduled to begin by winter 2004.

Wetland Management Zone Effectiveness Monitoring Program

Purpose

This program will be designed to assess the effectiveness of Wetland Management Zones in meeting FFR resource objectives and performance targets. The wetland management zone rules are based on a number of assumptions, including:

1. Meeting the wetland performance targets will achieve the functional objectives.
2. Certain BMPs work better than others.
3. We can determine how effective BMPs are (to a generalized degree). We can standardize how we measure and document this effectiveness.
4. Reaching BMP objectives at the site scale (i.e., avoiding road fill in wetlands) will aggregate to meeting sub-basin and watershed scale functional objectives.

These uncertainties form the basis for the critical questions (Table 23) that the program will be designed to address.

Strategy

Scoping to develop a strategy will begin in early 2005.

Table 23. Wetland Management Zone Effectiveness Monitoring Program.

Critical Questions	Project
Are current WMZs effective in providing adequate levels of LWD? Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids?	Wetland Management Zone Effectiveness Monitoring Project

Project Description

Wetland Management Zone Effectiveness Monitoring Project (Table 26, line 55)

This project has been neither scoped nor designed. This project is not scheduled to begin until 2006.

Wildlife Program

Purpose

Strategy

Project Description

RMZ Study Resample Project (Table 26, lines 53, 54)

In 1990, CMER funded an experimental study to examine the effects of two buffer configurations (state regulations and "smart buffers") on birds, small mammals and amphibians. The study produced 2 years of pre- and post-harvest data and a final report that was completed in 2000. The results were species specific and equivocal and raised numerous questions about the long-term response of wildlife to the treatments. Since the smart buffer was similar to the FFR buffer for Type F streams and more than five years had elapsed since the last sampling the RMZ, the resample project was initiated in FY 2003 to complete another 2 years of sampling to document changes over time. The study will provide additional data on riparian conditions and some SAAs. The project is scheduled for completion in FY 2006.

Ponderosa Pine Habitat (not in FFR budget)

A number of bird species are thought to be closely associated with mature Ponderosa pine forest. Currently, Ponderosa pine forests occur along a gradient from dense stands of Douglas-fir and grand fir with a few large remnant pines to low density open stands composed almost exclusively of large diameter pine. This project would examine the abundance of birds along this gradient on the east slope of the Cascade Mountains.

Other Wildlife Programs/Projects (not in FFR budget)

Due to the overriding importance of the FFR adaptive management program, funds for the Wildlife Program from CMER are limited and confined to those from the State General Fund. Due to these circumstances, none of the other programs in Table 11 have been developed into specific projects.

EXTENSIVE MONITORING PROGRAMS

Extensive monitoring evaluates the current statewide status and future trends of key watershed input processes and habitat conditions across FFR lands. Extensive monitoring is a landscape-scale assessment of the effectiveness of FFR rules to attain specific performance targets. This is different from prescription-effectiveness monitoring, which evaluates the effect of specific prescriptions at the site scale. Extensive monitoring is designed to provide annual or periodic report-card-type measure of rule effectiveness (i.e., do we meet the performance targets or how much have we improved over time) that can be used to by the regulatory agencies to determine if progress is consistent with expectations. Several extensive monitoring components were identified in the MDT report. CMER has identified several extensive monitoring programs, but further scoping and project design is needed, as well as CMER review and approval.

Mass wasting and roads rule groups are not included in the extensive monitoring program. Landscape-scale monitoring for mass wasting and roads does not lend itself to quick, report-card-type measures of rule effectiveness. Monitoring in these rule groups requires more involved, data-intensive and field work-intensive studies, such as complete landslide inventories linked with storm and management histories, and detailed road inventories linked to road surface erosion modeling, and tracking of BMP implementation over time. For this reason mass wasting and roads landscape-scale monitoring is incorporated into their respective effectiveness monitoring programs

Extensive Riparian Trend Monitoring Program

Purpose

The purpose of this program is to obtain an unbiased estimate of the distribution of stream temperature and shade, and riparian stand characteristics across FFR lands.

Strategy

A study design for the extensive riparian trend-monitoring program is being developed by RSAG. The program will address the critical questions in Table 23 concerning the current status and future trends of riparian stand characteristics and related stream habitat conditions on FFR lands. RSAG anticipates that sampling will be stratified by region (eastside and west side) and by stream type (Type F and Type N). The program will be implemented in stages by sampling the Westside strata first. Site selection requires accurate information on the location and typing of streams and the western Washington stream-typing model is expected to be available in July of 2004. Once the eastern Washington version of the stream typing model is complete, sampling will begin on the Eastside.

Project Description

Extensive Riparian Monitoring Project (Table 26, line 65)
Scoping for this project is currently underway. RSAG intends to submit a draft study plan to CMER for review in the summer of 2004.

Extensive Fish Passage Trend Monitoring Program

Purpose

The Monitoring Design Team defines extensive monitoring as a population-scale assessment of the effectiveness of the FFR rules in attaining forest practice related performance targets across FFR lands (Monitoring Design Team, 2002). The implied FFR performance target for fish passage based upon the requirements for Road Maintenance and Abandonment Plans (RMAP's) is to eliminate fish blockages on FFR regulated lands. This program will be designed to evaluate status and trends in fish passage conditions at forest road crossings.

Strategy

The extensive fish passage monitoring program is composed of two projects: the development of the study design, and the subsequent implementation of the study design. Each project will be coordinated by an ISAG project manager and approved by ISAG and CMER. The study design will be developed in 2004.

Project Description

Extensive Fish Passage Trend Monitoring Project (Table 26, line 67)

The study design for fish passage trend monitoring will be developed using guidelines consistent with the Forests and Fish Report, and supplied by ISAG. The contractor (WDFW) will first review possible monitoring approaches and present a recommended study design and methodology to ISAG for review. After modifications are incorporated, ISAG will submit the draft plan to CMER for review and approval. As necessary peer review will be determined by CMER in consultation with ISAG.

A final monitoring plan document will be prepared based upon the review comments and presented to CMER for approval. This final document will serve as the plan for extensive fish passage monitoring.

Study Design Schedule

Develop IAA contract:	May - 2004
Review information and select methodology:	June – August 2004
Methodology presented to ISAG:	End of August 2004
Develop draft monitoring plan document:	September – November 2004
CMER and SRC review:	December 2004 – February 2005
Complete final monitoring plan document:	March 2005

Extensive Wetlands Trend Monitoring Program

Purpose

The wetlands extensive monitoring program will assess the status and trends of reforestation of forested wetlands harvested under FFR rules.

Strategy

This project requires that the wetland database project be complete. The database is listed under rule tools. The wetlands database project is not scheduled to begin until 2006.

Project Description

Extensive Wetlands Trend Monitoring Project (Table 26, line 68)

Scoping to develop a strategy has not occurred. Projects are currently proposed to begin in 2009 or 2010.

INTENSIVE MONITORING PROGRAM

Intensive monitoring is a watershed-scale research program that is designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR on aquatic resources. The evaluation of cumulative effects of multiple management actions on a system requires an understanding of how individual actions influence a site and how those responses propagate through the system. This understanding will enable the evaluation of the effectiveness of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. This program was identified in the MDT report as an essential component of an integrated monitoring program. CMER is in the process of scoping its intensive monitoring needs. A draft scoping paper that identifies potential objectives and critical questions has been prepared by CMER staff. Prioritization of intensive monitoring objectives is anticipated in the summer of 2004 and contacts with outside programs with similar interests in intensive monitoring are being pursued to identify opportunities for collaboration.

RULE IMPLEMENTATION TOOL PROGRAMS

Rule implementation tool programs/projects are designed to develop, refine or validate tools used to implement the forest practices rules. Two types of rule-tool projects are recognized:

1. Methodology Tool Development Projects develop, test or refine protocols, models, and guides that allow the identification and location of FFR specified management features, such as the Last Fish Model, various landslide screens, the Np/Ns break and SAA Sensitive Site Identification.
2. Target Verification Projects consist of studies designed to verify the validity of performance targets developed during FFR negotiations that the authors identified as having a weak scientific foundation, such as the DFC basal area targets.

Rule implementation tools differ from research and monitoring tools, which are required to implement a specific effectiveness-monitoring program, such as Road Surface Erosion Model. Monitoring implementation tools are included with the effectiveness monitoring programs.

CMER identified nine rule tool implementation programs consisting of 19 projects.

Type N Delineation Program

Purpose

The purpose of this program is to validate the default basin areas established by FFR negotiations and refine methodologies for identifying the perennial initiation point (upper extent of perennial flow in Type N streams).

Strategy

The Type N Delineation Program is designed to validate the basin area default values established by the FFR and to identify potential field criteria for locating the Type Np/Ns break in the field. The program consists of two projects – a pilot project to test field protocol and to obtain a sufficient number of basin areas to establish basin-area variability. The second phase will apply the field protocol to randomly selected stream basins across FFR lands in the state to establish the basin area required to maintain perennial flow in each FFR default region. The pilot project was completed in October, 2003 and submitted to Policy for review in November 2003 as part of the adaptive management process. Policy has requested SRC peer review for the pilot project report. The program is administered by UPSAG.

Project Descriptions

Perennial Stream Survey Pilot Project (Type N Stream Demarcation Study): (Table 26, line 94)

The pilot project produced a field methodology for identifying the break between seasonal flow (Ns streams) and perennial flow (Np streams), provided an initial assessment of the accuracy of the default basin area numbers, identified alternative default criteria, and developed an estimate of the sample size needed to achieve precision and accuracy objectives based on variability in basin areas above the Np/Ns break.

Perennial Stream Survey (Type N Stream Demarcation Study): Phase 2 Statewide Project (Table 26, line 95)

A statewide project that will refine/develop default criteria and possible field criteria that can be used to identify the Np/Ns break in the field. Design and implementation of this project is contingent on policy direction but initiation of some form of type N stream demarcation study is anticipated in 2006.

Sensitive Site Program

This program consists of two rule-tool implementation projects. The program began in 1999 and is managed by LWAG.

Purpose

Strategy

Project Descriptions

SAA Sensitive Sites Identification Methods Project (Table 26, line 97)

The purpose of the SAA sensitive site identification method project is to develop a practical methodology for identifying SAA sensitive sites, such as headwall seeps, side-slope seeps, and headwater springs. It is designed to answer the following critical questions:

- Are sites important to amphibians correctly identified by rule?
- Are rule-identified sites valuable for amphibians?
- Does sensitive site field identification need to be improved?

It is intended to inform the Type N riparian rule by providing a standard methodology (field guide) for field managers to identify SAA sensitive sites when designing harvest units. This project is currently underway and is being administered by LWAG.

SAA Sensitive Sites Characterization(Table 26, line 97)

The purposes of this project are to document the distribution and characteristics of sensitive sites as described by the FFR rule and to verify their utilization and habitat value for SAA. It will generate information on the characteristics of sensitive sites, validate the extent to which they are utilized by amphibians, and determine if other sensitive sites exist. Information from this project could result in changes to the sensitive area criteria in the rules to better focus buffer protection on areas important to SAA. This project is currently underway and is being administered by LWAG.

Stream Typing Program

ISAG and DNR Forest Practices Division staff administer this program.

Purpose

The purpose of this program is develop a statewide stream typing map, described as follows in the Forest and Fish Report:

> *"The rule to be adopted by the Forest Practices Board will include a statewide map delineating the waters of the state into three categories: Type S waters, Type F waters and Type N waters. The map is to be developed using a multi-parameter, field-verified GIS logistic regression model pursuant to the adaptive management procedures described in Appendix L. The multi-parameter model will be "habitat driven" and will use geomorphic parameters such as basin size, gradient, elevation and other indicators. Electro fishing and day or night snorkeling and other non-lethal methods may be used with appropriate state and federal permits to do research and effectiveness monitoring for the purpose of developing and testing a habitat-based model or improving the model at five year intervals."*

Strategy

ISAG has been charged with implementation of the rule tool and addressing scientific questions that arise.

Project Descriptions

Last Fish/Habitat Prediction Model Development Project (Table 26, line 99)

The purpose of this project is to develop a GIS-based logistic regression fish habitat model(s) to identify and map the upstream boundary of Type F (fish-habitat) streams. This project will inform the stream-typing rule by providing the consistent, statewide mapping system required by the FFR agreement. This project is currently underway. A preliminary model for western Washington is completed and the modeled end of fish points (MEOFP) have been generated. Preliminary maps will be released for public preview July 1, 2004. Work on eastern Washington began April 2004.

Annual/Seasonal Variability Project (Table 26, line 101)

Seasonal and annual variability will be characterized to understand how modeled points vary with time. Work was begun on Annual Variability 2000-2001 for identifying last fish and also assessing sampling error. With only 2 years of data, results suggested that there may be no difference in annual variability. No work has been done on Seasonal Variability. A seasonal variability study will be drafted in late 2004, and field studies will be conducted by season in 2005.

Last Fish/Habitat Prediction Model Update & Validation (Table 26, line 100)

This project objective is validation and assessment of model predictions to accurately evaluate model performance and future applicability. The study design will be develop an approach and methodology to investigate the performance of the model in correctly determining fish habitat across watersheds of western Washington.

Guidelines for Field Protocol to Locate Mapped Divisions (Table 26, line 102)

Protocols and methods with be developed and proposed for adoption for the Forest Practices Board Manual Section 23. Through the Validation study protocols and methods will be tested and evaluated to establish a recommendation for the Forest Practices Board.

Type F DFC Validation Program

The program is being administered by RSAG. This program is designed to address uncertainties about the DFC approach, including uncertainties about: 1) how well the current targets reflect mature unmanaged riparian conditions for conifer and mixed stands, 2) how accurately the DFC model predicts growth of riparian stands to age 140, 3) what sort of habitat conditions will be provided by mature riparian stands, and 4) how young stands of different composition and density develop as they mature.

Purpose

The purpose of this program is to validate the DFC approach for management of western Washington, conifer-dominated riparian stands on fish bearing streams, including the DFC performance targets and the DFC model.

Strategy

This program consists of several projects designed to answer a series of critical questions (Table 24). DFC target validation has been identified as a high priority issue. To manage conifer and

mixed riparian stands to achieve functions associated with mature stands, the DFC approach requires stand targets that reflect mature stand conditions, and a model that can accurately predict the trajectory of young stands to maturity. Validation of the DFC performance targets is a high priority. Work on the DFC target validation project began in 2000, and the project results were reviewed by CMER in the fall of 2003. Validation of the DFC model is another high priority project. Development of the study design was put on hold while RSAG waited to assess the feasibility of the regional riparian stand growth-mortality cooperative effort proposed by the UW to address this issue in a cost-effective manner. The DFC-Aquatic Habitat Project is a lower priority issue, consequently scoping on this project has not begun. The Pathways of Riparian Stand Development to Maturity Project is an outgrowth of the DFC target validation project, based on the realization that many young low density stands of mixed composition are not likely to achieve DFC without some form of intervention, and that a better understanding of the development of such stands is need to identify appropriate management approaches.

This program is assessing the validity of the DFC targets and the DFC model. We anticipate that the results will require Policy to consider changing the DFC targets and modifying the model used to project stand growth and mortality.

Table 24. Type F DFC Validation Program critical questions and issues.

Critical Questions	Projects
Do the DFC targets accurately reflect stand conditions for mature, unmanaged conifer-dominated west side riparian stands?	DFC Target Validation Project
Does the DFC growth and mortality model accurately predict the trajectory of west side conifer-dominated riparian stands to age 140?	DFC Trajectory Model Validation Project
What aquatic habitat conditions are associated with mature west side riparian stands?	DFC-Aquatic Habitat Project
How do mature stand structures develop from younger stands in a variety of stand compositions and densities?	Pathways of Riparian Stand Development to Maturity Project
What growth trajectories and success ional pathways are characteristic of hardwood-dominated riparian stands?	Red Alder Growth and Yield Model Project

Project Descriptions

DFC Target Validation Project (Table 26, line 104)

The purpose of this project is to collect data on stand characteristics from a random sample of mature unmanaged conifer-dominated riparian stands in western Washington; compare basal area per acre from the sample with the current DFC targets; and evaluate alternative parameters for characterizing DFC. Many components of the study have been completed. The pilot project was completed in 2001; sampling for the main study was done in the summer of 2002; and the draft project report was reviewed by CMER in 2003. Peer review was completed in the spring of 2004. A project to conduct additional sampling to characterize the age distribution trees and the level of regeneration in the DFC stands is being proposed by RSAG to address peer review comments.

DFC Trajectory Model Validation Project (Table 26, line 105)

This project will assess the accuracy of the DFC model in predicting riparian stand growth and trajectory from harvest age to the DFC target (age 140). This project will be designed to validate the DFC model as a tool to predict trajectory to the DFC target for both conifer-dominated and mixed stands. A study design has not been developed because of the potential for a regional riparian stand cooperative monitoring effort.

DFC-Aquatic Habitat Project (Table 26, line 106)

The purpose of this project is to determine the range of aquatic habitat associated with mature (DFC) riparian forest conditions. This study has been neither scoped nor designed.

Pathways of Riparian Stand Development to Maturity Project

The purpose of this project is to determine the development sequence of younger stands of various compositions and densities to mature stands. The study is intended to inform management of uneven-aged stands and those of low density or mixed composition. This study has been neither scoped nor designed.

Red Alder Growth and Yield Model Project

The purpose of this project is to develop a growth and yield model for red alder. Existing models either do not include red alder amongst the species simulated or use equations that are based on few field data. In this project, cooperators from across the PNW have contributed existing data that will be compiled and cleaned at the UW Stand Management Cooperative. A growth and yield model for red alder will developed from these data in a second phase of the project. Red alder is a dominant component of many riparian forests and although the model is not specific to riparian areas it will provide better information on the growth dynamics of these riparian stands then is currently available. CMER has contributed project development funds to this cooperative effort. This project is currently underway.

Eastside Riparian Type F Program

Intent of Rule

Provide stand conditions that vary over time within a range that meets functional conditions and maintains general forest health. Specified riparian functions include bank stability, wood recruitment, leaf litter fall, nutrients, sediment filtering, and shade. More specifically, the eastside rules were intended to create a range of riparian characteristics that a) fall within the range of historical variability, b) are sustainable or not at unnaturally high risk of catastrophic failure, and c) provide the functions that support the production of harvestable populations of salmonids. The eastside rules vary with elevation. The intent of the elevation bands was to capture the variations in historical disturbance regimes.

Summary of Rule Strategy

The eastside Type-F riparian rules utilize required riparian buffers designed to provide the specified functions and meet the intent of the rule. Riparian areas are divided into three zones, a core zone, an inner zone, and an outer zone. The width of the core zone is 30 feet. No harvest is allowed within this zone. This is intended to protect bank stability and maintain the trees that have the greatest influence on streamside shade and are highly likely to recruit to streams. The inner zone is defined as 45 feet for streams less than 15 feet in width and 70 feet for larger streams. The inner zone is managed to meet the specified intent and objectives of the rule. The

width of the outer zone varies with site class and ranges from 0 to 55 feet. The sum of the core zone, inner zone and outer zone approximates the length of a site potential tree, which varies with site class.

Allowable harvest within the inner and outer zones is different for each of three elevation bands, referred to as habitat types in the rules. These elevation bands were intended to reflect variations in natural disturbance regimes. Several management strategies are allowed in the inner zone, with the intent that the combined core and inner zones will place the stands on a trajectory that meets the objectives of the eastside rules (see 1.0 above). The management strategies for high elevation stands are similar to those for the Westside, with the exception that the width of the various zones is different. Management within the various bands includes a preference for leaving species of trees that were the dominant species under natural disturbance regimes.

Strategy

The eastside riparian strategy is designed to achieve three management objectives:

1) To create dynamic riparian stands and riparian processes that emulate those provided by natural riparian disturbance regimes,
2) To create healthy and sustainable riparian stand conditions and,
3) To create riparian stands that provides riparian functions necessary for the protection and recovery of salmon and aquatic amphibian species.

The Forest Practices Rules describe the management strategy as follows:

> *"For eastside forests, riparian management is intended to provide stand conditions that vary over time. It is designed to mimic eastside disturbance regimes within a range that meets functional conditions and maintains general forest health. These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an end of riparian stand development"* (WFPB, 2001).

The Eastern Washington Type-F riparian rules are based on the following assumptions:

1) The management strategies in the Type-F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2) The defined elevation bands are reasonably accurate reflections of the special distribution of historical disturbance regimes and species composition.
3) The management strategies will minimize risk of catastrophic events
4) The management strategies will put stands on a trajectory that will provide riparian functions needed to support harvestable populations of fish.
5) The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs for bull trout.

Uncertainties about the validity of the assumptions and the effectiveness of the rule lead to two critical questions:

1) What is the current range of conditions for eastside riparian stands and streams? Will application of the prescriptions result in stands that achieve eastside FFR riparian prescription objectives (forest health, riparian function and historic disturbance regimes)? What are appropriate LWD performance targets?

2) Can the shade/temperature relationships in the eastside temperature nomograph be refined?

Project Descriptions

To address these assumptions and critical questions, SAGE has scoped and developed the following projects:

Disturbance Regime Literature Review Project (Table 26, line 12)

This project has been undertaken to gain an understanding of what disturbance regimes existed in the past and how they affected riparian forests. This will help determine whether we can apply these past conditions to present riparian stands and meet the Desired Future Conditions for riparian function.

Large Woody Debris Literature Review (Table 26, line 11)

A is in progress to help gain an understanding of the dynamics of functional stream wood and to a lesser degree the linkage between the level of LWD recruitment and the health of aquatic habitat. Addressing the uncertainty will require additional information on the relationship of LWD recruitment and habitat function. There is uncertainty about the response to aquatic habitat to different types or levels of LWD input and loading, and consequently on how much LWD riparian buffers need to produce.

Eastside Temperature Nomograph Project (Table 26, line 107)

The purpose of this project is to update and validate the shade-elevation-temperature relationships in the eastside temperature requirements nomograph. This project will refine the nomograph using existing data and identify gaps for future study. This will identify site characteristics necessary to produce a better predictive model of stream temperatures in eastern Washington.

Eastside Riparian Current Condition Assessment Project (Table 26, line 13)

Eastern Washington has a wide range of climactic conditions, elevations, forest types, riparian zones, and management history. Riparian health/function information over this range of conditions is limited. An evaluation, or baseline study, of current riparian forest stands is needed to determine whether they are meeting required functions for fish habitat and where they fit into the historical disturbance regime and/or current disturbance regime. This will also help to develop targets to accomplish prescription assessment/evaluation.

Bull Trout Habitat Identification Program

Purpose

Strategy

This program is administered by BTSAG and consists of three projects.

Project Descriptions

Bull Trout Presence/Absence Protocols (Table 26, line 109)

This active project is developing a set of protocols for assessing the presence of Bull Trout. This project has been funded with USFWS bull trout funds to date.

Bull Trout Habitat Prediction Models (Table 26, line 110)

This project will be designed to improve the accuracy of the method used to identify Bull Trout habitat for forest management purposes. This project has been funded with USFWS bull trout funds to date.

Yakima River Radiotelemetry

This active project is designed to evaluate the migratory patterns of bull trout and to identify their distribution and habitat preferences in the Yakima River watershed. The information gained from this project will inform bull trout presence/absence protocols and habitat prediction models. This project has been funded with USFWS bull trout funds to date.

CMZ Delineation Program

Purpose

The purpose of the CMZ program is to develop methods and criteria for accurately identifying and delineating CMZ.

Strategy

This program will develop materials and procedures to aid field managers in the consistent and accurate delineation of CMZs. It consists of two projects. The first will provide a screening tool to locate areas with potential CMZs and second will provide a methodology to accurately delineate their boundaries once located. The program is not being actively developed because of its low ranking in the CMER priority list. Because the program is providing tools, we do not anticipate that program results will require Policy action. The program is being administered by UPSAG.

Project Descriptions

CMZ Screen and Aerial Photograph Catalog Project (Table 26, line 125)

This GIS-based project will be designed to identify potential CMZs based on slope and valley width data and to overlay on this map the historic DNR aerial photographs documenting past migration behavior.

CMZ Boundary Identification Criteria Project (Table 26, line 126)

This project will be designed to develop criteria and a consistent and uniform method to define the margins (edges) of the CMZ.

Unstable Landform Identification Program

Purpose

The purpose of the unstable landform identification program is to provide a set of screening tools to identify forested areas containing potentially unstable slopes to focus field verification activities on potential problem areas and thereby improve our ability to avoid them.

Strategy

This program consists of five projects that provide statewide information on the distribution of unstable landforms. The management strategy for regulating forest practices on unstable slopes consists primarily of an administrative process for identifying and reviewing forest practices on potentially unstable slopes. The main elements include defining and screening unstable slopes and improvements to the State Environmental Protection Act (SEPA) process. The success of the management strategy for unstable slopes is dependent on early recognition of potentially unstable slopes by forest managers in order to avoid or mitigate the hazards posed by them. The projects in this program are specifically referenced in the FFR as necessary for implementing forest practices that meet resource objectives.

Several projects are underway or completed and it is anticipated that the rule tools will be completely developed by 2008. Because the projects are developing screening tools, we do not anticipate that program results will require Policy action. The program is administered by UPSAG.

Project Descriptions

Shallow Rapid Landslide Screen for GIS (Table 26, line 112)

The first phase of this project developed a GIS-based screen of modeled slope stability based on DEM topography for the Westside. It was completed in 2002. A second phase to identify topographic model(s) appropriate for similar mapping on the Eastside is on hold while the recently approved Landslide Hazard Zonation (LHZ) Project is being conducted. Should the LHZ project not complete mapping of the Eastside, the Eastside GIS screen could be used to complete coverage. The Westside screen becomes one component of the LHZ project in areas where the landslide hazard zonation will be completed.

Technical Guidelines for Geotechnical Reports (Table 26, line 113)

This project develops technical guidelines for geotechnical reports used in the SEPA review process. The guidelines will include identification of appropriate analytical tools and techniques appropriate for different projects and at different scales.

Regional Unstable Landforms Identification (Map/Deep-Seated Landslide Screen) (Table 26, line 114)

This active project provides a coordinator to work with TFW cooperators within each DNR region in order to identify unstable landforms that do not meet the present statewide landform descriptions. The project also serves as an interim screen for deep-seated landslides by identifying lithologies that promote deep-seated landslides; however, it is not intended to map them. The results of this program are being incorporated into the LHZ project.

Landslide Hazard Zonation (Table 26, line 115, 116, 117)

This is a multi-phase project. A completed phase has collected and collated Watershed Analyses including information on unstable landforms and placed this information in a GIS database. A currently active phase Landform Hazard Classification System & Mapping Protocols Project is (1) developing a statewide standard for assigning hazard to unstable slopes and (2) completing unfinished mass wasting assessments in partially completed Watershed Analyses. The proposed last phase will provide consistent identification and evaluation of unstable landforms in high priority areas that are not covered by Watershed Analyses and are within FFR jurisdiction.

Glacial Deep-seated Landslide Program

Purpose

The purpose of the Glacial Deep-seated Landside Program is to develop a tool for assessing the failure potential of deep-seated landslides in glacial sediments resulting from changes in groundwater hydrology during and after timber harvest in the landslide recharge area.

Strategy

This program consists of two projects that are designed to develop and test an analytical model for assessing recharge impacts of timber harvest. The approach is to first undertake a project develop an analytical procedure to estimate the increased recharge that may result from harvest. The second project will expand this procedure into a model that incorporates site specific conditions. The results of these studies will probably lead to a reassessment of the glacial-recharge area rule by Policy. The projects are administered by UPSAG.

Project Descriptions

Model Evapo-Transpiration in Deep-Seated Landslide Recharge Areas (Table 26, line 119)

This completed project developed an analytical model for assessing the evapo-transpiration changes resulting from timber harvest. The model is intended to be applied to timber harvest within the recharge area of deep-seated landslide in glacial sediments. The model has been developed but was not directly validated and refined because of insufficient field data. We anticipate reopening the project and implementing a validation/refinement study as a second phase when the appropriate data field data become available.

Method to Assess Vulnerability of Deep-Seated Landslides to Timber Harvest (Table 26, line 120)

This multiphase project will integrate the existing analytical model with site-specific slope stability analysis to develop a site-specific assessment methodology that determines the potential for failure of deep-seated landslides subject to harvest in the recharge area. We anticipate two phases: Phase 1 will integrate the evapo-transpiration model with a soil moisture/recharge/slope stability model and Phase 2 will field test the model.

Wetland Tool Program

Purpose

Strategy

This program consists of two projects and is administered by WETSAG.

Project Descriptions

Hydrogeomorphic Wetland Classification System (Table 26, line 122)

This project will be designed to identify hydrologic and geomorphic criteria to aid in the classification of wetlands.

DNR GIS Wetlands Data Layer (Table 26, line 123)

This project will be designed to develop a GIS data-layer based on physical properties utilizing the hydro-geomorphic classification system.

4.0 CMER ACTION PLAN

INTRODUCTION

This chapter describes the action plan to implement CMER research and monitoring agenda. It begins with a section describing how CMER established priorities among programs based on an assessment of risk and scientific uncertainty. This is followed by a section describing how individual projects were prioritized based factors such as extent to which projects are essential in accomplishing FFR adaptive management objectives, the status of some projects relative to policy decisions on adaptive management, input from DNR relative importance of rule tool projects, and need to complete work that is already underway. The chapter concludes with a section on the proposed budget and schedule action plan, which integrates CMER program and project priorities, describes how funds will be allocated to move priority project forward, and provides a schedule and timeline for work on priority projects.

PROGRAM PRIORITIES

The first step in the prioritization process was to rank the relative importance of proposed programs in meeting FFR goals and objectives in order to focus CMER resources and effort on critical areas. This is an important step because over the near-term the proposed research and monitoring projects exceed the availability of funding and the capabilities of human resources. Establishing priorities will allow CMER to pursue research and monitoring objectives in an orderly manner over time. The CMER strategy for program ranking and prioritizing its work is based on discussions with the FFR policy committee, the group with oversight responsibility for reviewing CMER priorities and budget. The program prioritization strategy is to:

1. Rank effectiveness/validation monitoring and extensive monitoring programs on the basis of scientific uncertainty and risk to aquatic resources;
2. Rule tool programs will be evaluated in consultation with DNR on their importance for rule implementation and prioritized on a project basis

3. The intensive monitoring program needs further scoping and coordination with other efforts before it can be prioritized and integrated into the CMER action plan.

Effectiveness/Validation and Extensive Monitoring Program Rankings

Effectiveness/validation and extensive trend monitoring programs were ranked by CMER members in attendance at the December 19, 2002 CMER meeting who assessed the merit of each program by asking two questions:

1. How certain are we of the science and/or assumptions underlying the rule?
2. How much risk is there to the protected resource if the science and/or assumptions underlying the rule are incorrect?

These questions were chosen to rank programs because uncertainties and gaps exist in the scientific foundation for the FFR and the underlying assumptions about risks to aquatic resources. CMER was charged with reducing these uncertainties through effectiveness and validation monitoring and research and then recommending modifications to the rules as necessary through the adaptive management process. Uncertainty is a measure of confidence in the science underlying a rule, including the scientific relationships providing the conceptual foundation for the rule, the assumptions incorporated into the prescription, or the response to the prescription when it is applied on the ground. High uncertainty (low certainty) indicates that little is known about the underlying science and the rule is likely based on speculation and poorly informed assumptions. It may also indicate that the prescription treatment is untested, and the performance under field conditions is unknown. Low uncertainty (high certainty) indicates that the science underlying the rule is well known and accepted, or that the prescription (or similar treatments) has already been evaluated under similar conditions. Risk is a measure of the potential for detrimentally impacting aquatic resources and thus undermining the intent of the FFR goals, e.g. harvestable fish populations, stream associated amphibians, and water quality. A high-risk assignment indicates the rule component under study has a greater potential to alter the resource because of its high magnitude, frequency, and/or direct linkage to the resource. A low risk assignment indicates that the rule component has a lesser potential to alter the resource because of its low magnitude, frequency, and/or indirect linkage to the resource.

The individual scores were averaged to obtain mean risk and mean uncertainty scores for each program. These were multiplied to get a combined score that was used to rank effectiveness/ validation and extensive trend monitoring programs. The results are presented in Table 25. The FFR Policy Group accepted the rankings and instructed CMER to use them as the basis for prioritizing effectiveness/validation and extensive trend monitoring projects.

Table 25. CMER rankings for effectiveness/validation programs.

Program Title	Overall Ranking	Uncertainty		Risk	
		Mean	Rank	Mean	Rank
Effectiveness/Validation Programs					
Type N Buffer Characteristics, Integrity Function	1	4.4	1	3.9	1
Eastside Type F Desired Future Range and Target	2	4.2	2	3.8	2
Type N Amphibian Response	3	4.2	2	3.7	3
Road Basin-scale Effectiveness Monitoring	4	3.4	5	3.4	4
Type F Statewide Prescription Monitoring	5	3.2	7	3.1	6
Mass Wasting Effectiveness Monitoring	6	3.2	6	2.9	8
Eastside (BTO) Temperature	7	3.0	9	3.2	5
Wetlands Revegetation Effectiveness	8	3.5	4	2.7	11
Road Site-scale Effectiveness Monitoring	9	2.6	14	3.1	6
Hardwood Conversion	10	3.0	8	2.6	12
Wetland Mitigation	11	2.8	11	2.7	10
Fish Passage Effectiveness Monitoring	12	2.6	14	2.9	9
Wildlife Program	13	2.9	10	2.4	14
Wetland Management Zone Effectiveness Mon.	14	2.8	12	2.5	13
CMZ Effectiveness Monitoring	15	2.7	13	2.1	15
Forest Chemicals	16	2.0	16	2.1	16
Extensive Trend Monitoring Programs					
Extensive Riparian Monitoring	1	3.5	2	3.5	1
Extensive Mass Wasting Monitoring	2	3.7	1	2.9	3
Extensive Fish Passage Monitoring	3	3.1	3	3.1	2

PROJECT PRIORITIES

The next step in developing the action plan was to make decisions about budget and scheduling for individual projects proposed by various SAGs. To do this, individual projects were assigned to categories based on their importance to the adaptive management program and their current status. The system for categorizing projects is as follows:

- (P) Policy. Projects being implemented at policy request or projects which require policy action before they can proceed.
- (E) Essential. Projects that are critical components of high priority effectiveness/validation or extensive monitoring programs based on risk and uncertainty (see section 4.2 above) or important rule tool programs. Essential projects were also screened for consistency with the intent of FFR.
- (F) Finish. Projects that are currently underway and should be completed.
- (blank) Unrated. Projects that do not fit into one of the previous three categories.

The projects were initially sorted into these categories by the CMER co-chairs. This work was presented to CMER and discussed at the December 2003 meeting. After making some revisions,

CMER approved the list of projects and the categorizations which form the basis of the 2004 CMER Action Plan.

CMER ACTION PLAN

The CMER action plan lists projects, the categories they are assigned to and budget information (including the currently approved budget for FY 2004 as well as projected budgets for future years). Projects with approved budgets for FY 2004 are either underway, or are expected to be initiated in FY 2004. Projects without approved budgets for FY 2004 but with proposed budgets for future years are in the planning stage. Implementation of these projects will depend upon obtaining approval for the requested funds from the Forest Practices Board. The action plan table is available through the Forest Practices Division Adaptive Management Program Administrator [(360) 902-1400 or fpd@wadnr.gov]. The action plan table is not shown here as it is updated and revised on a regular basis.